US 20170213974A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2017/0213974 A1**

ADACHI et al. (43) **Pub. Date: Jul. 27, 2017**

(54) **ORGANIC LIGHT-EMITTING DEVICE, HOST MATERIAL, LIGHT-EMITTING MATERIAL, AND COMPOUND**

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(21) Appl. No.: **15/125,286**

(22) PCT Filed: **Mar. 4, 2015**

(86) PCT No.: **PCT/JP2015/056285**

§ 371 (c)(1),
(2) Date: **Sep. 12, 2016**

(30) **Foreign Application Priority Data**

Mar. 11, 2014 (JP) 2014-047342

Publication Classification

(51) **Int. Cl.**

H01L 51/00	(2006.01)
C09K 11/06	(2006.01)
C07F 5/02	(2006.01)
C09K 11/02	(2006.01)

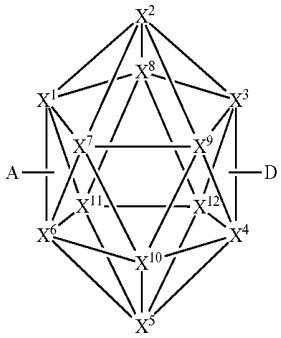
(52) **U.S. Cl.**

CPC ***H01L 51/008*** (2013.01); ***C09K 11/025*** (2013.01); ***C09K 11/06*** (2013.01); ***C07F 5/027*** (2013.01); *C09K 2211/1007* (2013.01); *C09K 2211/1059* (2013.01); *C09K 2211/1096* (2013.01); *H01L 51/5012* (2013.01)

(57) **ABSTRACT**

A high light emission efficiency can be achieved by the use of a compound represented by the general formula (1) as a host material or a light-emitting material of a light-emitting layer of an organic light-emitting device. X^1 to X^{12} each independently represent C or BH constituting carborane, provided that among X^1 to X^{12}, the bonding positions to A and D each represent C, and the other thereof each represent BH; A represents an acceptor bonded to the carborane through an aromatic ring or a heteroaromatic ring; and D represents a donor bonded to the carborane through an aromatic ring or a heteroaromatic ring.

General Formula (1)



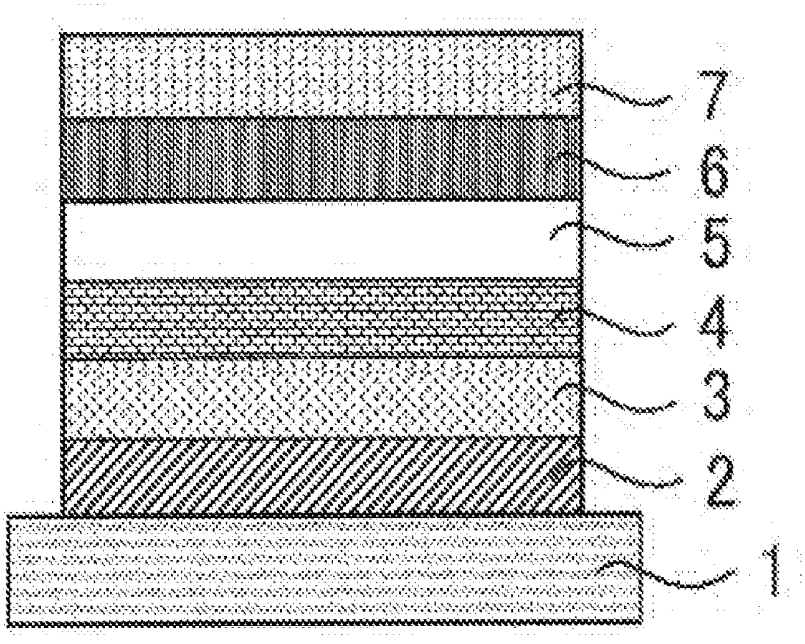


Fig. 1

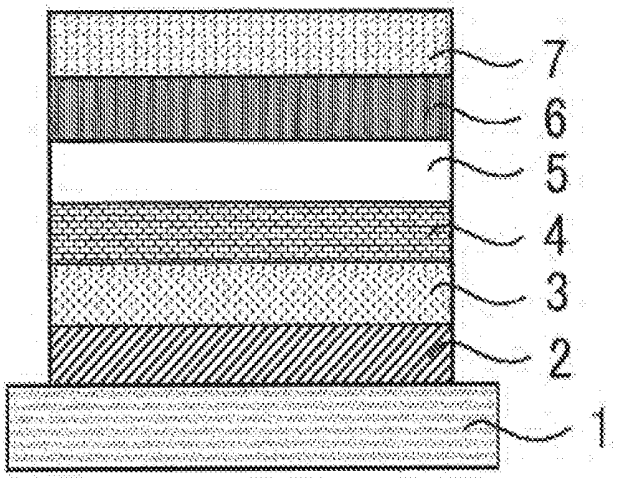

7
6
5
4
3
2
1

Fig. 2

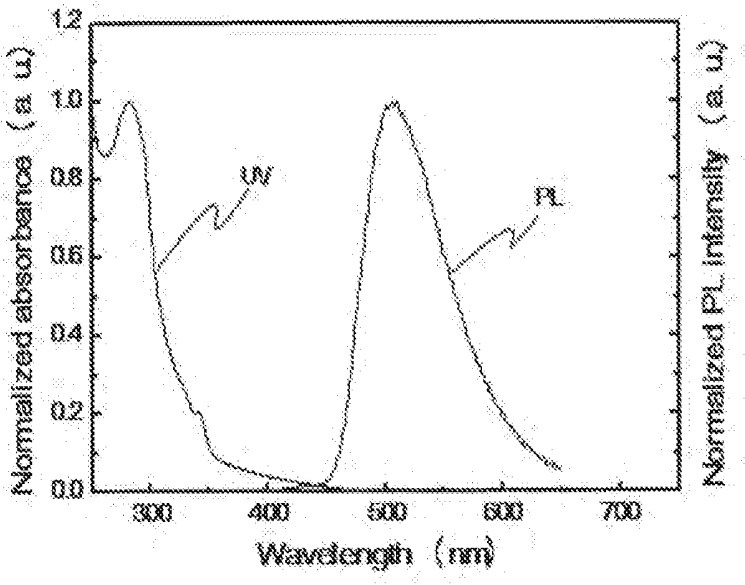

Normalized absorbance (a.u.)
Normalized PL intensity (a.u.)
Wavelength (nm)
UV
PL
0.0
0.2
0.4
0.6
0.8
1.0
1.2
300
400
500
600
700

Fig. 3

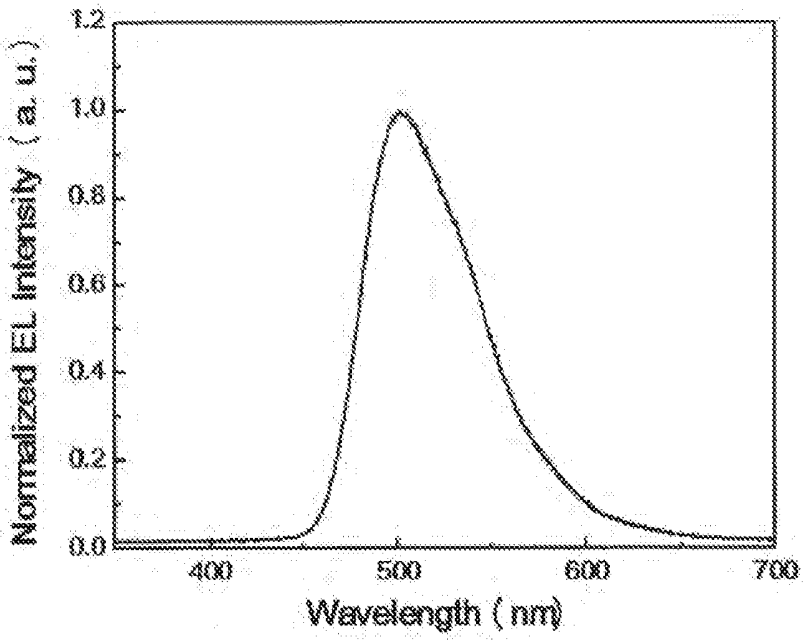

Normalized EL Intensity (a. u.)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
400
500
600
700
Wavelength (nm)

Fig. 4

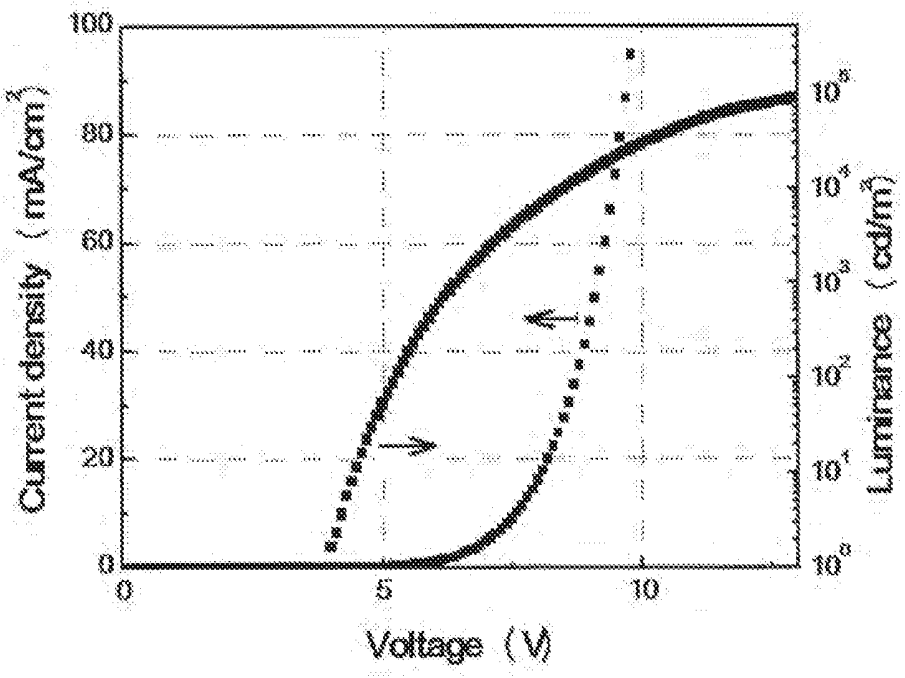

Current density (mA/cm^2)
100
80
60
40
20
0
0
5
10
Voltage (V)
Luminance (cd/m^2)
10^5
10^4
10^3
10^2
10^1
10^0

Fig. 5

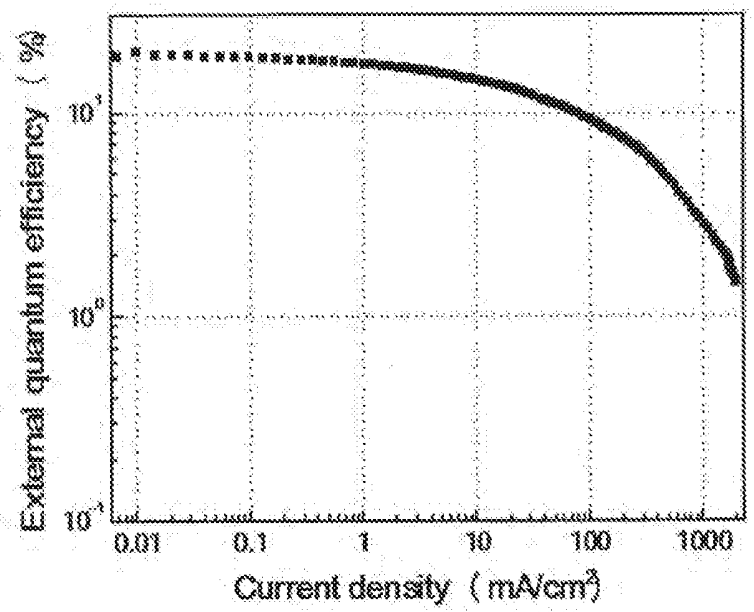

External quantum efficiency (%)
10¹
10⁰
10⁻¹
0.01
0.1
1
10
100
1000
Current density (mA/cm²)

Fig. 6

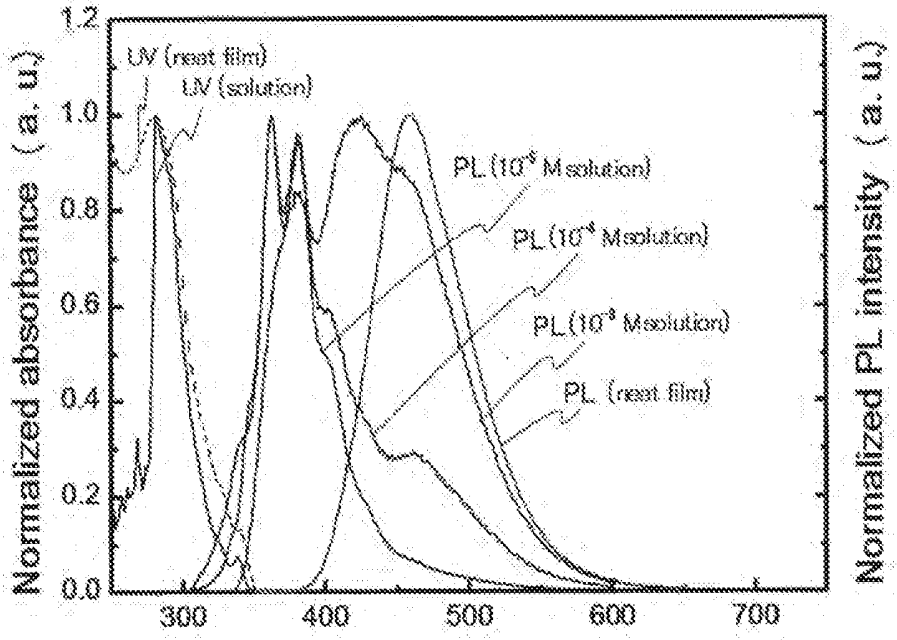

Normalized absorbance (a. u.)
Normalized PL intensity (a. u.)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
UV (neat film)
UV (solution)
PL (10⁻⁵ M solution)
PL (10⁻⁴ M solution)
PL (10⁻³ M solution)
PL (neat film)
300
400
500
600
700

Fig. 7

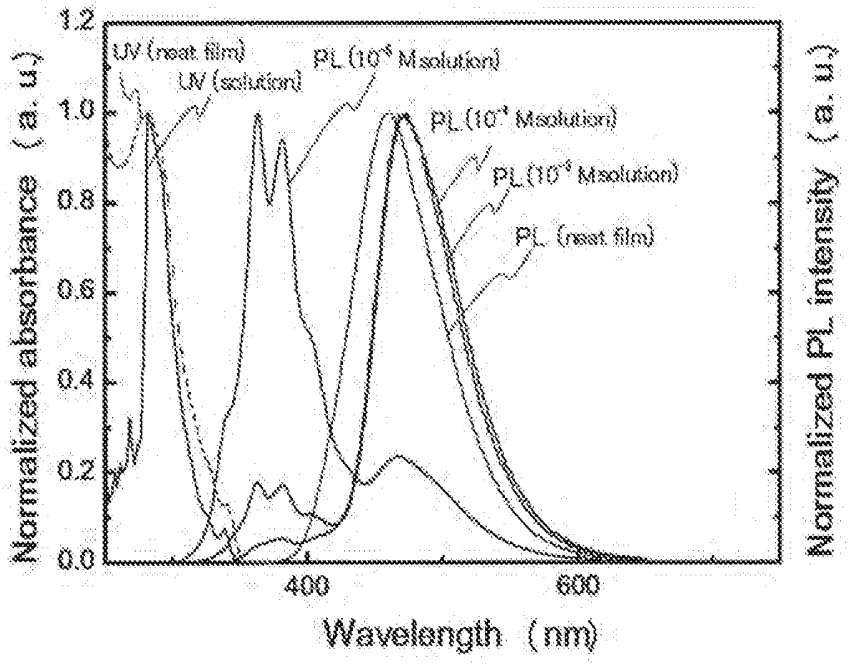

UV (neat film)
UV (solution)
PL (10^{-5} M solution)
PL (10^{-4} M solution)
PL (10^{-3} M solution)
PL (neat film)
Normalized absorbance (a. u.)
Normalized PL intensity (a. u.)
Wavelength (nm)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
400
600

Fig. 8

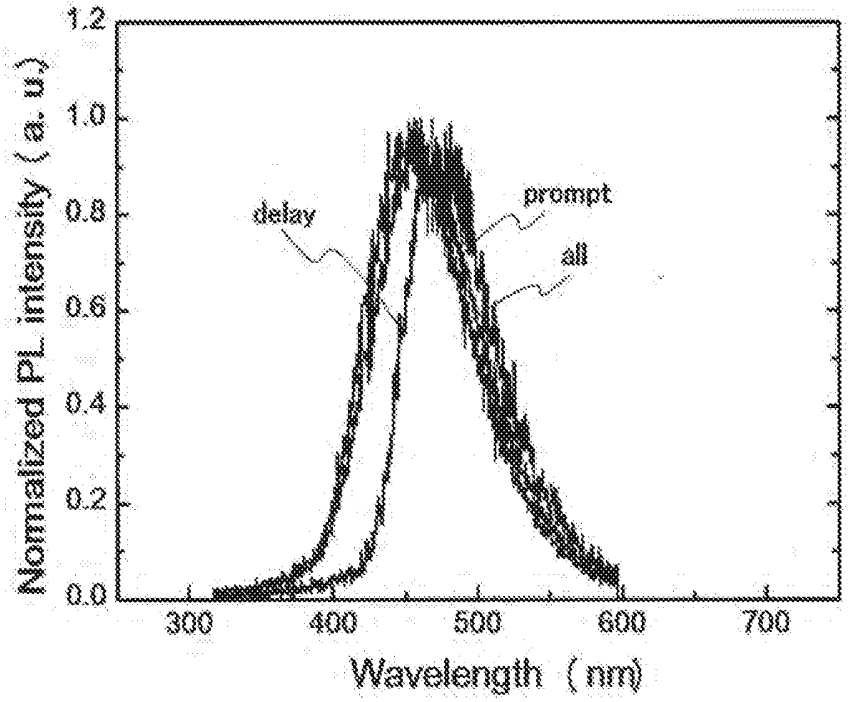

delay
prompt
all
Normalized PL intensity (a. u.)
Wavelength (nm)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
300
400
500
600
700

Fig. 9

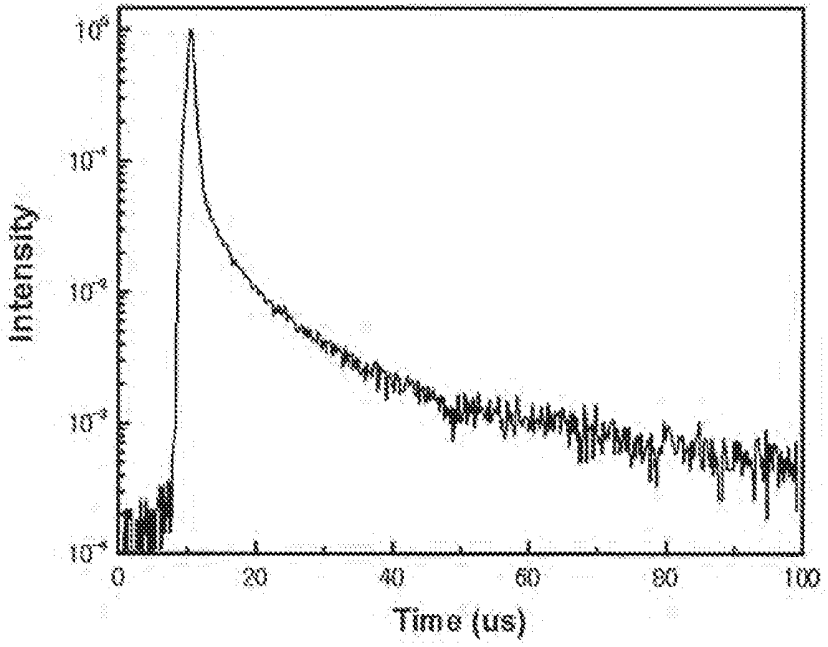
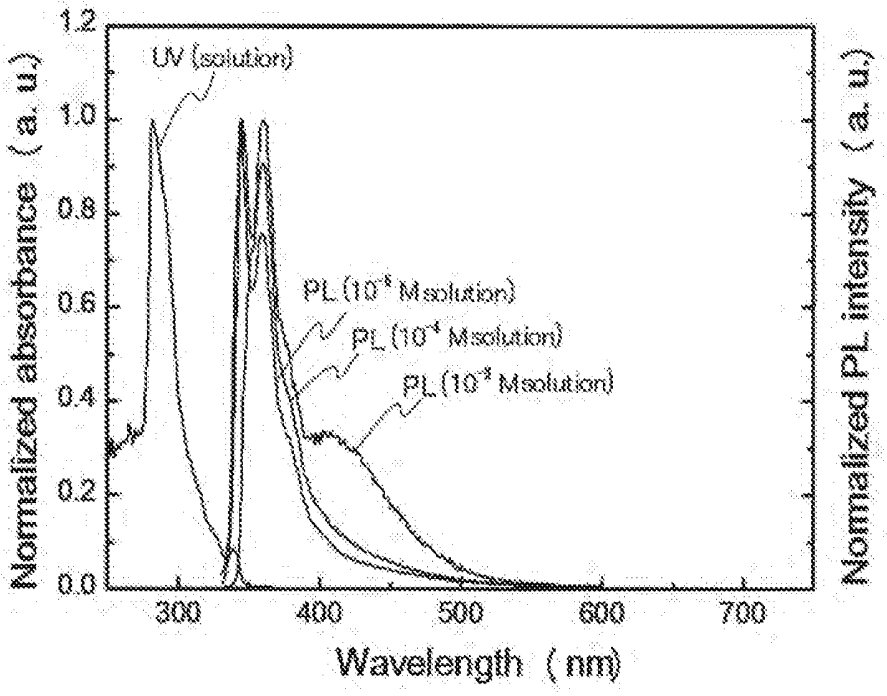

Intensity
Time (us)
0
20
40
60
80
100

Fig. 10


UV (solution)
PL (10⁻⁶ M solution)
PL (10⁻⁴ M solution)
PL (10⁻³ M solution)
Normalized absorbance (a. u.)
Normalized PL intensity (a. u.)
Wavelength (nm)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
300
400
500
600
700

ORGANIC LIGHT-EMITTING DEVICE, HOST MATERIAL, LIGHT-EMITTING MATERIAL, AND COMPOUND

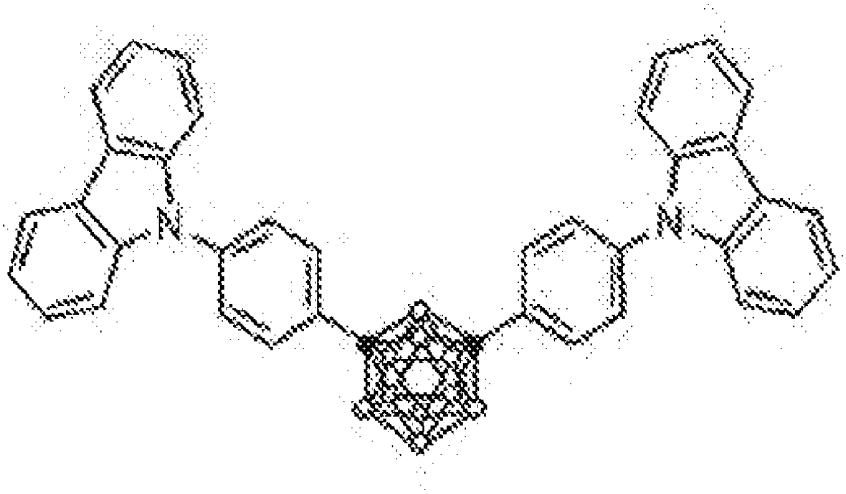
TECHNICAL FIELD

[0001] The present invention relates to a compound that, is useful as a host material and the like, and an organic light-emitting device using the same.

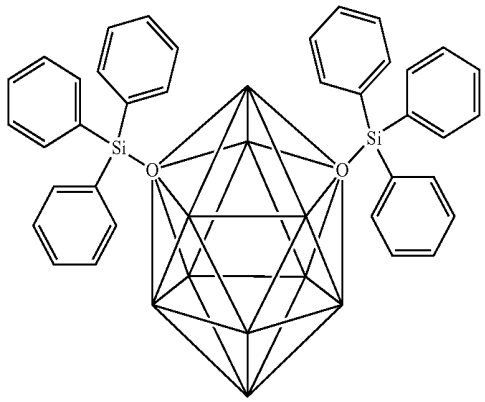
BACKGROUND ART

[0002] An organic light-emitting device, such as an organic electroluminescent device (organic EL device), has been actively studied for enhancing the light emission efficiency thereof, in particular, various studies for enhancing the light-emitting efficiency have been made by newly developing and combining an electron transporting material, a hole transporting material, a light-emitting material, a host, material, and the like constituting an organic electroluminescent device. Among these, there are studies relating to an organic electroluminescent device utilizing a compound having a carborane structure.

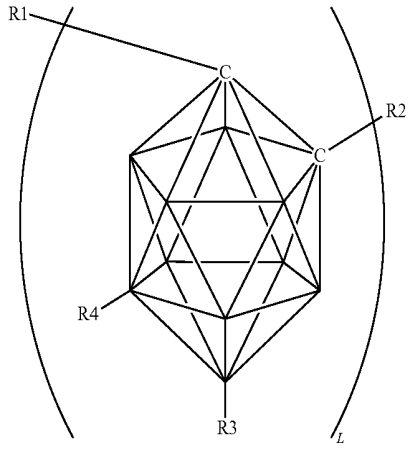
[0003] Non-patent Document 1 describes the results of studies on the characteristics as a host material for blue phosphorescence of a carborane derivative represented by the following formula and a compound having a carbazolylphenyl group bonded to an o-position or a p-position of a carborane structure. However, the compounds described in Non-patent Document 1 are all symmetric molecules having the groups bonded to the carborane structure that are the same as each other, and a compound having different groups that are bonded to a carborane structure is not described.



[0004] Patent Document 1 describes a carborane derivative having silyl groups bonded thereto represented, for example, by the following formula and a compound having a silyl group and another group bonded to a carborane structure, and describes an example using the carborane derivative as a host material in a light-emitting layer present between a pair of electrodes constituting an organic electroluminescent device. However, the carborane derivatives shown in Patent Document 1 are all compounds having a silyl group bonded to a carborane structure, and the literature does not describe n carborane derivative having combined therewith a group other than a silyl group.



[0005] Patent Document 2 describes the usefulness of a carborane derivative represented by the following general formula as a material for an electron transporting layer of an organic electroluminescent device. In the formula herein, it is stated that R^1 to R^8 each represent a hydrogen atom, a substituted or unsubstituted alkyl group, a substituted or unsubstituted aryl group, a substituted or unsubstituted heterocyclic group, a substituted or unsubstituted condensed polycyclic aromatic group, or a substituted or unsubstituted condensed polycyclic heterocyclic group, and compounds, in which R^7 and R^8 are carbazolylphenyl groups, are described as specific examples thereof. However, Patent Document 2 does not confirm the usefulness of the carborane derivative represented by the following general formula as a host material and a light-emitting material.



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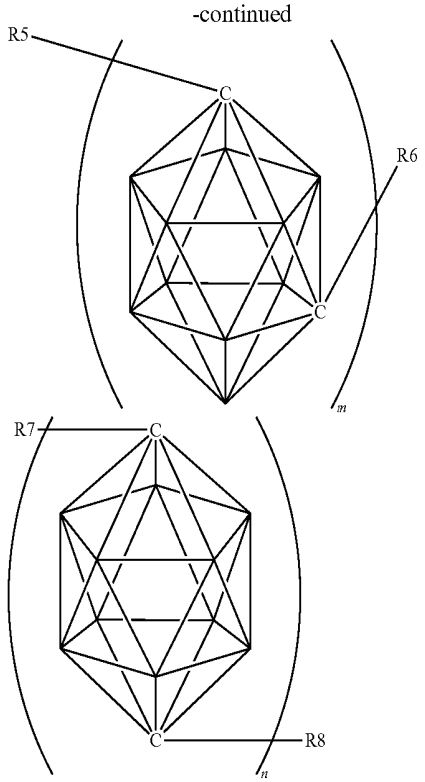


CITATION LIST

Non-Patent Literature

[0006] Non-patent Document 1: J. Am. Chem. Soc. 2012, 134, 17982-17990

Patent Literatures

[0007] Patent Document 1: WO 2013/088934

[0008] Patent Document 2: JP-A-2005-166574

SUMMARY OF INVENTION

Technical Problem

[0009] As described above, Non-patent Document 1 describes the results of studies on the characteristics as a host, material of the compound having two carbazolylphenyl groups bonded to the carborane structure. However, as a result of actual evaluation by the present inventors of the characteristics as a host material of the compound having two carbazolylphenyl groups bonded to the carborane structure, it has been found that the characteristics are not sufficiently satisfactory, and there is a demand of providing a host material having better characteristics.

[0010] The inventors then start to investigate variously a group of compounds having a carborane structure, have firstly found that among many compounds having a carborane structure, a group of compounds having a structure containing a carborane structure having an acceptor and a donor bonded thereto has usefulness as a host material and the like, and have decided to continue further investigations. As described above, Patent Document 1 describes an example using the compound containing a carborane structure having silyl groups bonded thereto as a host material of

a light-emit ting layer. However, a silyl group does not function as an acceptor or a donor, and Patent Document 1 does not describe a compound containing a carborane structure having an acceptor and a donor bonded thereto. Patent Document 2 describes the usefulness of a compound containing a carborane structure having two carbazolylphenyl groups bonded thereto as a material for an electron transporting layer, and furthermore Non-patent Document 1 describes the result of investigations on the characteristics of the compound as a host material. Herein, a carbazolylphenyl group functions as a donor. However, Patent Document 1 and Non-patent Document 1 do not describe a compound containing a carborane structure having both a donor and an acceptor bonded thereto. Accordingly, for a compound containing a carborane structure having an acceptor and a donor bonded thereto, the usefulness as a host material, and the like of the compound cannot be estimated.

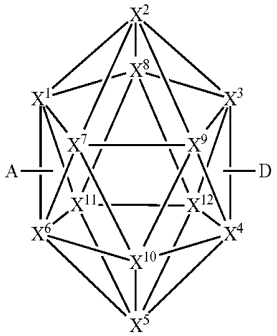
[0011] Under the circumstances, the inventors have further made investigations on the usefulness as a host material and the like of a compound containing a carborane structure having an acceptor and a donor bonded thereto, and have made accumulated studies for finding a compound having excellent characteristics as a host material and the like. Furthermore, the inventors have made earnest investigations for providing a general formula of compounds useful as a host material and generalizing the structure of an organic light-emitting material having a high light emission efficiency.

Solution to Problem

[0012] As a result of the earnest investigations performed, the inventors have found that compounds containing a carborane structure having an acceptor and a donor bonded thereto through an aromatic ring or a heteroaromatic ring has excellent properties as a host, material and the like. The inventors also have found that the group of compounds includes compounds that are useful as a light-emitting material, such as a delayed fluorescent material, and have clarified that an organic light-emitting device having a high light emission efficiency can be provided inexpensively. Based on the knowledge, the inventors have provided the following inventions as measures for solving the problems.

[0013] [1] An organic light-emitting device containing a compound represented by the following general formula (1);

General Formula (1)



wherein in the general formula (1), X^1 to X^{12} each independently represent C or BH constituting carborane, provided that among X^1 to X^{12}, the bonding positions to R and D each represent C, and the other thereof each represent BH; A represents an acceptor bonded to the carborane through an aromatic ring or a heteroaromatic ring; and D represents a donor bonded to the carborane through an aromatic ring or a heteroaromatic ring.

[0014] [2] The organic light-emitting device according to the item [1], wherein the organic light-emitting device contains the compound represented by the general formula (1) in a light-emitting layer.

[0015] [3] The organic light-emitting device according to the item [2], wherein the organic light-emitting device contains the compound represented by the general formula (1) as a host material.

[0016] [4] The organic light-emitting device according to the item [3], wherein the light-emitting layer further contains a delayed fluorescent emitter.

[0017] [5] The organic light-emitting device according to the item [2], wherein the organic light-emitting device contains the compound represented by the general formula (1) as a light-emitting material.

[0018] [6] The organic light-emitting device according to any one of the items [1] to [5], wherein in the general formula (1), D is bonded ho the carborane through a benzene ring.

[0019] [7] The organic light-emitting device according to any one of the items [1] to [6], wherein in the general formula (1), D has a diphenylamino group or a carbazolyl group.

[0020] [8] The organic light-emitting device according to any one of the items [1] to [7], wherein in the general formula (1), D represents a group represented by the following general formula (2):

$$[(R^1)(R^2)N]_{n1}—Ar^1— \qquad \text{General Formula (2)}$$

wherein in the general formula (2), R^1 and R^2 each independently represent a substituent, provided that R^1 and R^2 may be bonded to each other to form a cyclic structure; n1 represents an integer of from 1 to 4; and Ar^1 represents a substituted or unsubstituted aromatic group having a valence of (n1+1).

[0021] [9] The organic light-emitting device according to the item [8], wherein in the general formula (2), n1 represents 1 or 2.

[0022] [10] The organic light-emitting device according to any one of the items [1] to [9] wherein in the general formula (1), A has a heteroaromatic ring containing a nitrogen atom.

[0023] [11] The organic Light-emitting device according to the item [10], wherein in the general formula (1), A has a triazine ring.

[0024] [12] The organic light-emitting device according to the item [11], wherein the triazine ring is substituted with a phenyl group.

[0025] [13] The organic light-emitting device according to any one of the items [10] to [12], wherein in the general formula (1), A is bonded to the carborane through the heteroaromatic ring containing a nitrogen atom.

[0026] [14] The organic light-emitting device according to any one of the items [10] to [12], wherein in the general formula (1), A represents a group represented by the following general formula (3):

$$(Het)_{n2}\text{-}Ar^2— \qquad \text{General Formula (3)}$$

wherein in the general formula (3), Het represents a substituted or unsubstituted heteroaromatic ring group (provided that the heteroaromatic ring group contains a nitrogen atom as a ring structure constituting atom); n2 represents an

integer of from 1 to 4; and Ar^2 represents a substituted or unsubstituted aromatic group having a valence of (n2+1).

[0027] [15] The organic light-emitting device according to the item [14], wherein in the general formula (3), n2 represents 1 or 2.

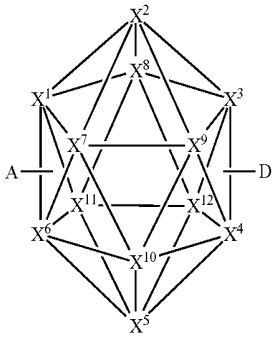
[0028] [16] The organic light-emitting device according to any one of the items [11] to [15], wherein the compound represented by the general formula (1) is an o-carborane compound or a m-carborane compound.

[0029] [17] The organic light-emitting device according to any one of the items [1] to [16], wherein the organic light-emitting device is an organic electroluminescent device.

[0030] [18] The organic light-emitting device according to any one of the items [1] to [17], wherein the organic light-emitting device emits delayed fluorescent light.

[0031] A host material containing a compound represented, by the following general formula (1):

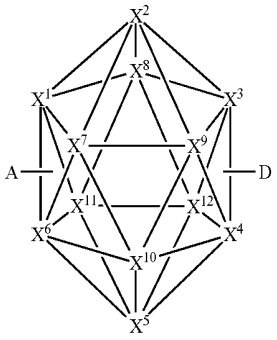
General Formula (1)



wherein in the general formula (1), X^1 to X^{12} each independently represent C or BH constituting carborane, provided that, among X^1 to X^{12}, the bonding positions to A and D each represent C, and the other thereof each represent BH; A represents an acceptor bonded to the carborane through an aromatic ring or a heteroaromatic ring; and D represents a donor bonded to the carborane through an aromatic ring or a heteroaromatic ring.

[0032] [20] A light-emitting material containing a compound represented by the following general formula (1):

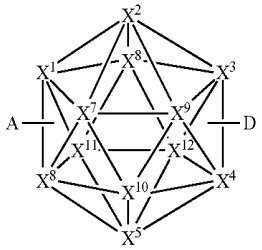
General Formula (1)



wherein in the general formula (1), X^1 to X^{12} each independently represent C or BH constituting carborane, provided that among X^1 to X^{12}, the bonding positions to A and D each represent C, and the other thereof each represent BH; A represents an acceptor bonded to the carborane through an aromatic ring or a heteroaromatic ring; and D represents a donor bonded to the carborane through an aromatic ring or a heteroaromatic ring.

[0033] [21] A delayed fluorescent emitter containing a compound represented by the following general formula (1):

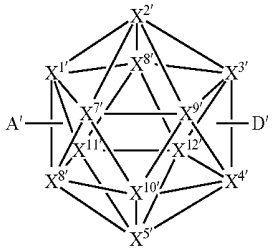
General Formula (1)



wherein in the general formula (1), X^1 to X^{12} each independently represent C or BH constituting carborane, provided that among X^1 to X^{12}, the bonding positions to A and D each represent C, and the other thereof each represent BH; A represents an acceptor bonded to the carborane through an aromatic ring or a heteroaromatic ring; and D represents a donor bonded to the carborane through an aromatic ring or a heteroaromatic ring.

[0034] [22] A compound represented by the following general formula (1'):

General Formula (1')



wherein In the general formula (1'), $X^{1'}$ to $X^{12'}$ each independently represent C or BH constituting carborane, provided that among $X^{1'}$ to $X^{12'}$, the bonding positions to A' and D' each represent C, and the other thereof each represent BH; A' represents an acceptor bonded to the carborane through an aromatic ring or a hetero-aromatic ring; and D' represents a donor bonded to the carborane through an aromatic ring or a heteroaromatic ring,

Advantageous Effects of Invention

[0035] The compound represented by the general formula (1) is useful, as a host material and/or a light-emitting material. The compound of the invention includes one that emits delayed fluorescent light. The organic light-emitting device using the compound of the invention as a host material or a light-emitting material is capable of achieving a high light emission efficiency.

BRIEF DESCRIPTION OF DRAWINGS

[0036] FIG. **1** shows a schematic cross sectional view showing an example of a layer structure of an organic electroluminescent device.

[0037] FIG. **2** shows the light emission and absorption spectra of the thin film organic photoluminescent device of 4CzIPN and the compound 1 in Example 1.

[0038] FIG. **3** shows the light emission spectrum of the organic electroluminescent device of 4CzIPN and the compound 1 in Example 2.

[0039] FIG. **4** is a graph showing the voltage-current density-luminance characteristics of the organic electroluminescent device of 4CzIPN and the compound 1 in Example 2.

[0040] FIG. **5** is a graph showing the current density-external quantum efficiency characteristics of the organic electroluminescent device of 4CzIPN and the compound 1 in Example 2.

[0041] FIG. **6** shows the light emission and absorption spectra of the toluene solutions before bubbling with nitrogen and the thin film organic photo luminescent device of the compound 1 in Example 3.

[0042] FIG. **7** shows the light emission and absorption spectra of the toluene solutions after bubbling with nitrogen and the thin film organic photoluminescent device of the compound 1 in Example 3.

[0043] FIG. **8** shows the light emission spectra for fluorescent light, delayed fluorescent light, and total fluorescent light of the organic photoluminescent device of the compound 1 in Example 3.

[0044] FIG. **9** shows the transient decay curve of the organic photoluminescent device of the compound 1 in Example 3.

[0045] FIG. **10** shows the light emission and absorption spectra of the toluene solution of the compound 2 in Example 4.

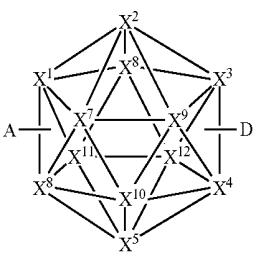
DESCRIPTION OF EMBODIMENTS

[0046] The contents of the invention will be described in detail below. The constitutional elements may be described below with reference to representative embodiments and specific examples of the invention, but the invention is not limited to the embodiments and the examples. In the description, a numerical range expressed with reference to an upper limit and/or a lower limit means a range that includes the upper limit and/or the lower limit. In the invention, the hydrogen atom that is present in a molecule of the compound used in the Invention is not particularly limited in isotope species, and tot example, all the hydrogen atoms in the molecule may be ^{1}H, and all or a part of them may be ^{2}H (deuterium (D)).

Compound Represented by General Formula (1)

[0047] The organic light-emitting device of the invention contains a compound represented by the following general formula (1).

General Formula (1)



[0048] In the general formula (1), X^1 to X^{12} each independently represent C or BH constituting carborane, provided, that among X^1 to X^{12}, the bonding positions to ft and D each represent C, and the other thereof each represent BH. Among X^1 to X^{12}, the bonding positions to A and D may be any of X^1 to X^{12}, and in the case where any one of A and D is bonded to X^1, the other thereof is preferably bonded to X^2 or X^3. Accordingly, the compound represented by the general formula (1) is preferably an o-carborane compound or a m-carborane compound. Among X^1 to X^{12}, BH may have a substituent substituting the hydrogen atom. For the descriptions and the preferred ranges of the substituent capable of being substituted on X^1 to X^{12}, reference may be made to the descriptions and the preferred ranges of the substituent that may be represented by R^1 and R^2 described later.

[0049] D represents a donor bonded to the carborane through an aromatic ring or a heteroaromatic ring. The "donor" referred in the invention means an aromatic substituent having an electron donating function to the carborane.

[0050] The donor represented by D has at least one aromatic ring or heteroaromatic ring, and is bonded to the carborane through the aromatic ring or heteroaromatic ring. Examples of the aromatic ring and the heteroaromatic ring include a benzene ring, a pyridine ring, a pyridazine ring, a pyrimidine ring, a triazine ring, a triazole ring, a thiazole ring, and a pyrrole ring, and the donor is preferably bonded to the carborane through a benzene ring among these. The bonding position to the carborane in the aromatic ring or the heteroaromatic ring is not particularly limited, and the donor is preferably bonded to the carborane at a carbon atom among the atoms constituting the aromatic ring or the heteroaromatic ring.

[0051] D preferably has a diphenylamino group or a carbazolyl group. The diphenylamino group and the carbazolyl group may be substituted with a substituent. For the descriptions and the preferred ranges of the substituent capable of being substituted or the diphenylamino group and the carbazolyl group, reference may be made to the descriptions and the preferred ranges of the substituent that may be represented by R^1 and R^2.

[0052] D is also preferably a group represented by the following general formula (2).

$$[(R^1)(R^2)N]_{n1}—Ar^1— \qquad \text{General Formula (2)}$$

[0053] In the general formula (2), R^1 and R^2 each independently represent a substituent.

[0054] Examples of the substituent that may be represented by R^1 and R^2 include a hydroxy group, a halogen atom, a cyano group, an alkyl group having from 1 to 20 carbon atoms, an alkoxy group having from 1 to 20 carbon atoms, an alkylthio group having from 1 to 20 carbon atoms, an alkyl-substituted amino group having from 1 to 20 carbon atoms, an acyl group having from 7 to 20 carbon atoms, an aryl group having from 6 to 40 carbon atoms, a heteroaryl group having from 3 to 40 carbon atoms, an alkenyl group having from 2 to 10 carbon atoms, an alkynyl group having from 2 to 10 carbon atoms, an alkoxycarbonyl group having from 2 to 10 carbon atoms, an alkylsulfonyl group having from 1 to 10 carbon atoms, a haloalkyl group having from 1 to 10 carbon atoms, an amide group, an alkyl amide group having from 2 to 10 carbon atoms, a trialkylsilyl group having from 3 to 20 carbon atoms, a trialkylsilylalkyl group

having from 4 to 20 carbon atoms, a trialkylsilylalkenyl group having from 5 to 20 carbon atoms, a trialkylsilylalkynyl group having from 5 to 20 carbon atoms, and a nitro group. In these specific examples, the substituent that is capable of being further substituted with a substituent may be substituted. More preferred examples of the substituent include a halogen atom, a cyano group, a substituted or unsubstituted alkyl group having from 1 to 20 carbon atoms, an alkoxy group having from 1 to 20 carbon atoms, a substituted or unsubstituted aryl group having from 6 to 40 carbon atoms, a substituted or unsubstituted heteroaryl group having from 3 to 40 carbon atoms, and a dialkyl-substituted amino group having from 1 to 20 carbon atoms. Further preferred examples of the substituent include a fluorine atom, a chlorine atom, a cyano group, a substituted or unsubstituted alkyl group having from 1 to 10 carbon atoms, a substituted or unsubstituted alkoxy group having from 1 to 10 carbon atoms, a substituted or unsubstituted aryl group having from 6 to 15 carbon atoms, and a substituted or unsubstituted heteroaryl group having from 3 to 12 carbon atoms.

[0055] R^1 and R^2 may be bonded to each other to form a cyclic structure. The cyclic structure may be an aromatic ring or an aliphatic ring, and may be a structure containing a hetero atom, and the cyclic structure may be a condensed ring containing two or more rings. The hetero atom referred herein is preferably selected from the group consisting of a nitrogen atom, an oxygen atom, and a sulfur atom. Examples of the cyclic structure formed include a benzene ring, a naphthalene ring, a pyridine ring, a pyridazine ring, a pyrimidine ring, a pyrazine ring, a pyrrole ring, an imidazole ring, a pyrazole ring, a triazole ring, an imidazoline ring, an oxazole ring, an isoxazole ring, a thiazole ring, an isothiazole ring, a cyclohexadiene ring, a cyclohexene ring, a cyclopentaene ring, a cycloheptatriene ring, a cycloheptadiene ring, and a cycloheptaene ring.

[0056] n1 represents an integer of from 1 to 4, and preferably 1 or 2. In the case where n1 is an integer of from 2 to 4, the plural groups represented by $[(R^1)(R^2)N]$ may be the same as or different from each other.

[0057] Ar^1 represents a substituted or unsubstituted aromatic group having a valence of (n1+1). The aromatic group referred herein includes a monocyclic aromatic group and also includes an aromatic group having a ring aggregated structure containing two or more aromatic rings bonded through a single bond, such as biphenylene, and an aromatic group having a polycyclic condensed structure containing two or more aromatic rings condensed, such as naphthalene. Specifically, the aromatic group is preferably an aromatic hydrocarbon group having from 6 to 18 carbon atoms, more preferably a residual group of a benzene ring, a biphenylene ring, a naphthalene ring, a fluorene ring, or a triphenylene ring, further preferably a residual group of a benzene ring, and still further preferably a divalent residual group of a benzene ring having bonding positions at the 1-position and the 4-position (i.e., a 1,4-phenylene group). The aromatic group may be substituted with a substituent. For the descriptions and the preferred ranges of the substituent capable of being substituted on the aromatic group, reference may be made to the descriptions and the preferred ranges of the substituent that may be represented by R^1 and R^2 above.

[0058] A represents an acceptor bonded to the carborane through an aromatic ring or a heteroaromatic ring. The "acceptor" referred in the invention means an aromatic substituent hawing an electron withdrawing function to the carborane.

[0059] The acceptor represented by A has at least one aromatic ring or heteroaromatic ring, and is bonded to the carborane through the aromatic ring or heteroaromatic ring. For the specific examples of the aromatic ring and the heteroaromatic ring, reference may be made to the specific examples of the aromatic ring and the heteroaromatic ring of the donor bonded to the carborane. The bonding position to the carborane in the aromatic ring or the heteroaromatic ring is not particularly limited, and the acceptor is preferably bonded to the carborane at a carbon atom among the atoms constituting the aromatic ring or the heteroaromatic ring.

[0060] A preferably has a heteroaromatic ring containing a nitrogen atom. Examples of the heteroaromatic ring containing a nitrogen atom include a pyridine ring, a pyridazine ring, a pyrimidine ring, a triazine ring, a triazole ring, a thiazole ring, and a pyrrole ring, and a triazine ring is preferred. The heteroaromatic ring containing a nitrogen atom may be substituted with a substituent. For the descriptions and the preferred ranges of the substituent capable of being substituted on the heteroaromatic ring containing a nitrogen atom, reference may be made to the descriptions and the preferred ranges of the substituent that may be represented by R^1 and R^2 above. In the casts where the heteroaromatic ring containing a nitrogen atom is a triazine ring, the triazine ring is preferably substituted with a phenyl group. In the case where A has a heteroaromatic ring containing a nitrogen atom, the heteroaromatic ring containing a nitrogen atom may be bonded to the carborane through a single bond, or may be bonded to the carborane through an aromatic group Ar^2 as a linking group, as represented by the following general formula (3)

$$(Het)_{n2}\text{-}Ar^2— \qquad \text{General Formula (3)}$$

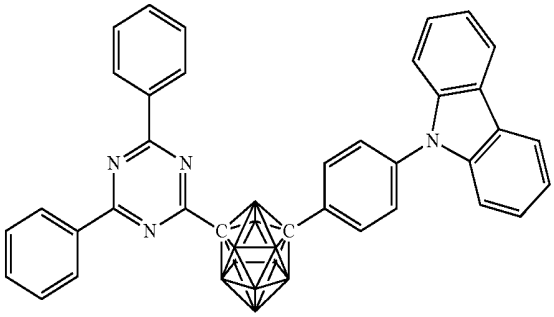
[0061] In the general formula (3), Het represents a substituted or unsubstituted heteroaromatic ring group (provided that the heteroaromatic ring group contains a nitrogen atom as a ring structure constituting atom). Examples of the heteroaromatic ring group containing a nitrogen atom include residual groups of a pyridine ring, a pyridazine ring, a pyrimidine ring, a triazine ring, a triazole ring, a thiazole ring, and a pyrrole ring, and a residual group of a triazine ring is preferred. In the case where the heteroaromatic ring group has a substituent, for the descriptions and the preferred ranges of the substituent, reference may be made to the descriptions and the preferred ranges of the substituent that may be represented by R^1 and R^2 above. In the case where the heteroaromatic ring group containing a nitrogen atom is a residual group of a triazine ring, the residual group of a triazine ring is preferably substituted with a phenyl group.

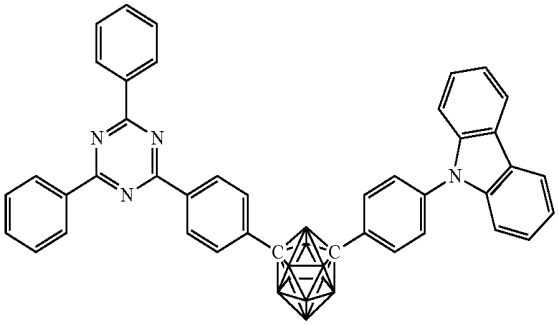
[0062] n2 represents an integer of from 1 to 4, and preferably 1 or 2. In the case where n2 is an integer of from 2 to 4, the plural groups represented by Het may be the same as or different from each other.

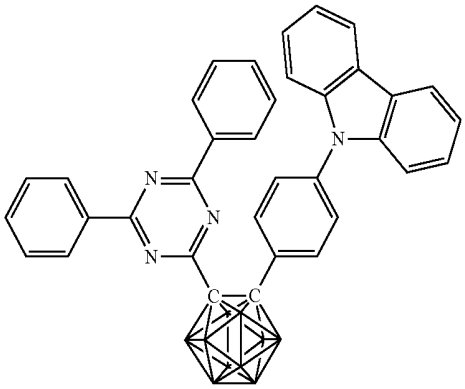
[0063] Ar^2 represents a substituted or unsubstituted aromatic group having a valence of (n2+1). For the descriptions and the preferred ranges of the aromatic group represented by Ar^2, reference may be made to the descriptions and the preferred examples of the aromatic group represented by Ar^1.

[0064] Preferred examples of the compound represented by the general formula (1) include a compound having a structure containing a m-carborane or an o-carborane having bonded thereto a donor D having a carbazole ring and an acceptor A having a triazine ring, and more preferred examples of the compound include a compound having a structure containing a m-carborane or an o-carborane having bonded thereto a donor D having a carbazole ring and an acceptor A having a triazine ring, in which at least the carbazole ring of D is bonded to the carborane through a phenylene ring.

[0065] Specific examples of the compound represented by the general formula (1) are shown below. However, the compound represented by the general formula (1) capable of being used in the invention is not construed as being limited to the specific examples.







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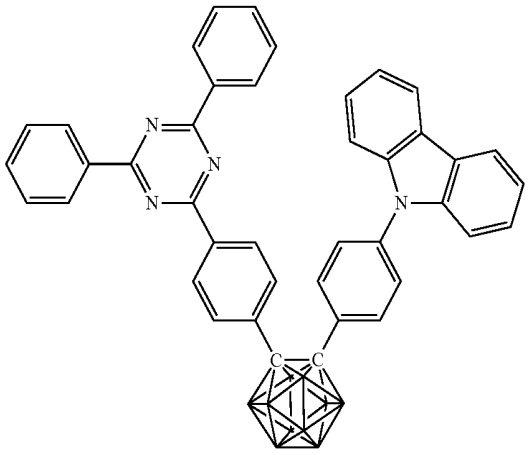

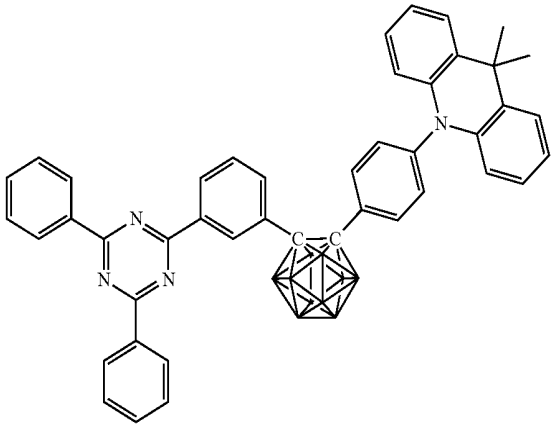

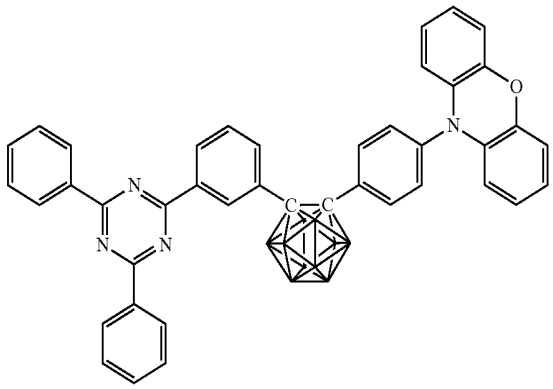

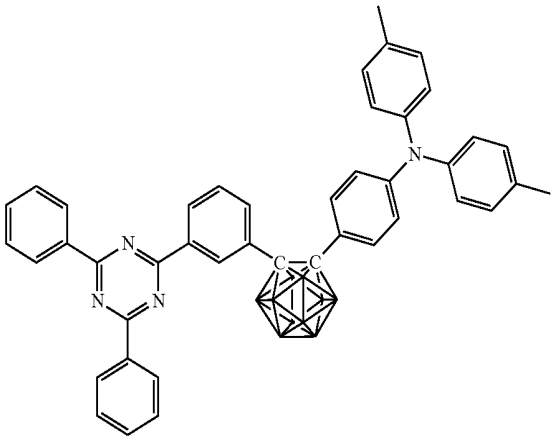

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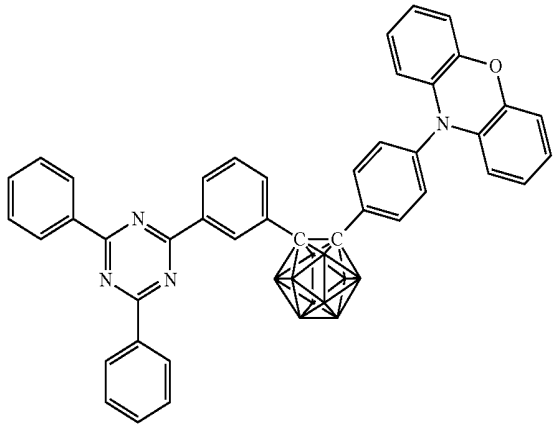

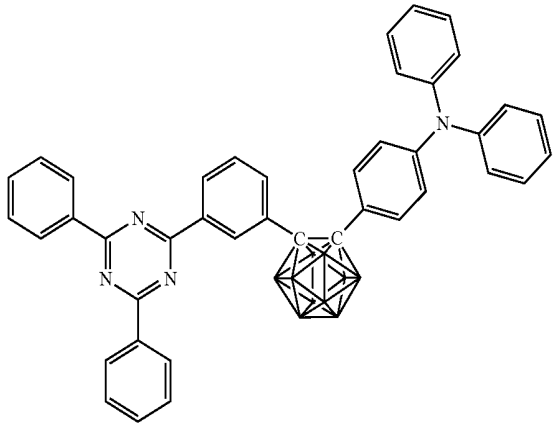

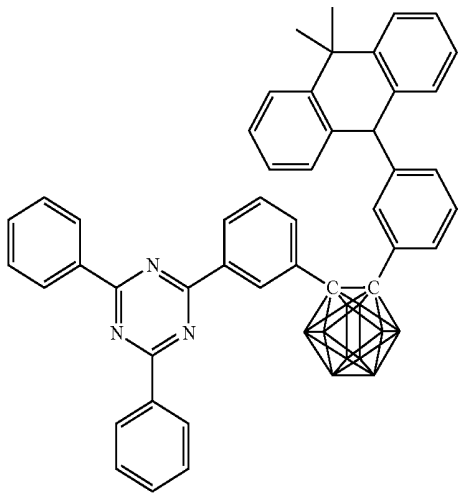

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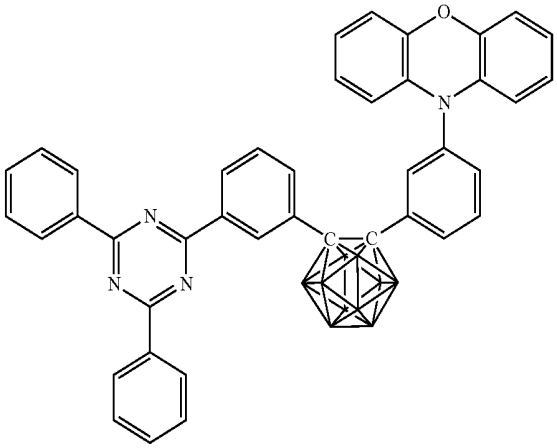

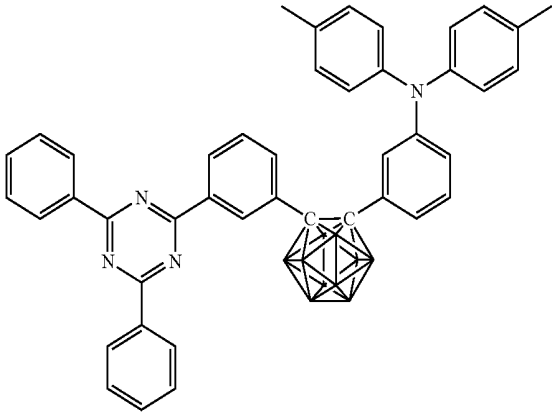

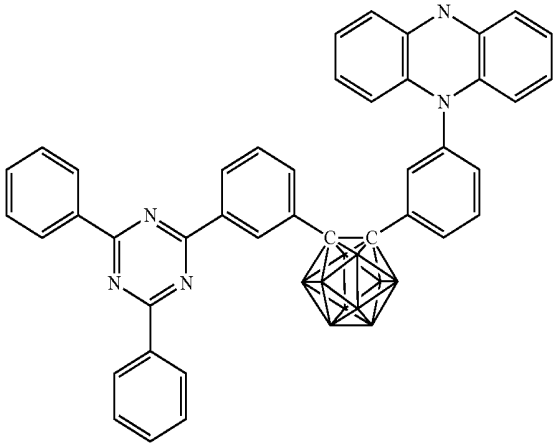

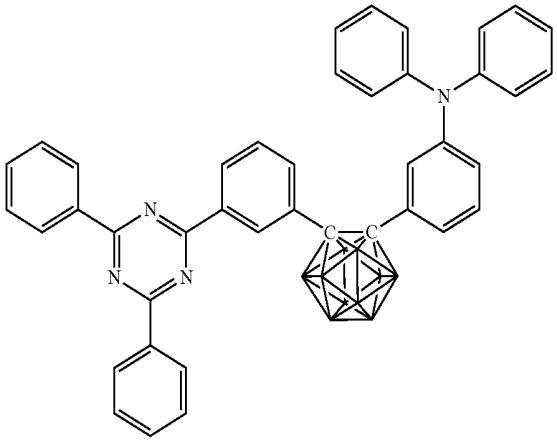

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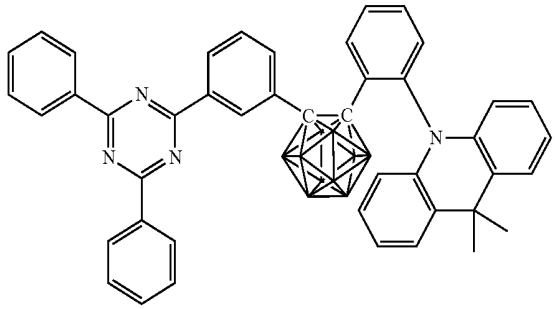

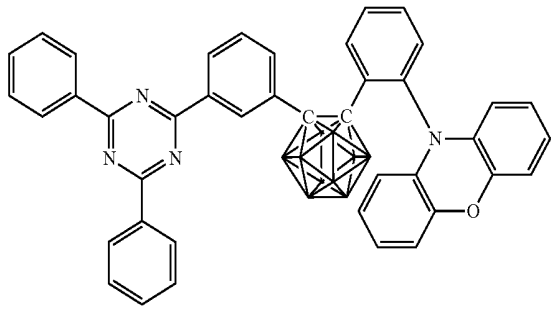

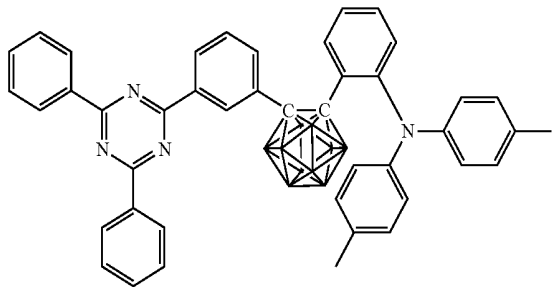

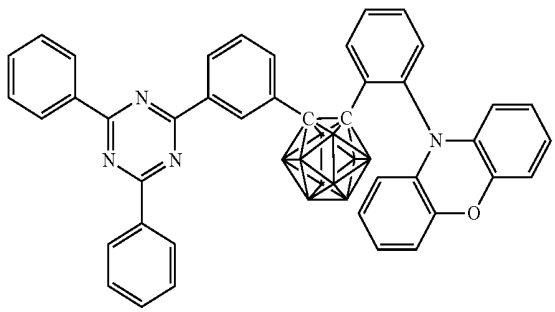

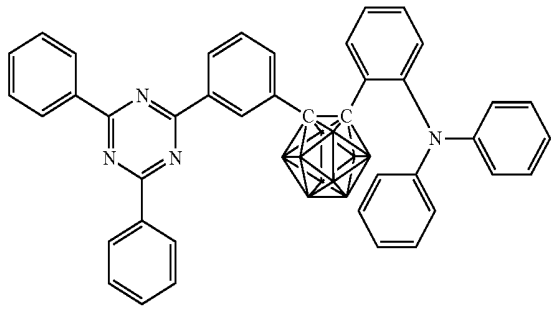

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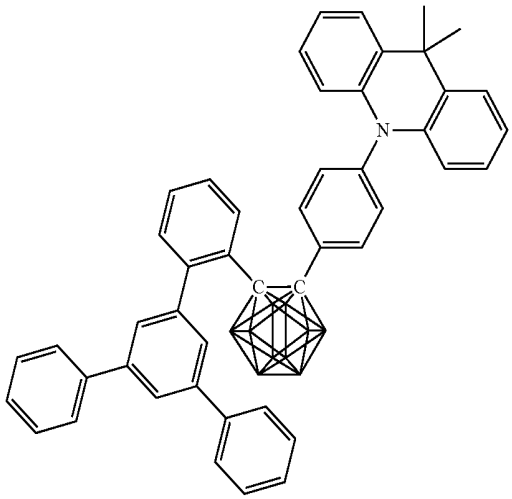

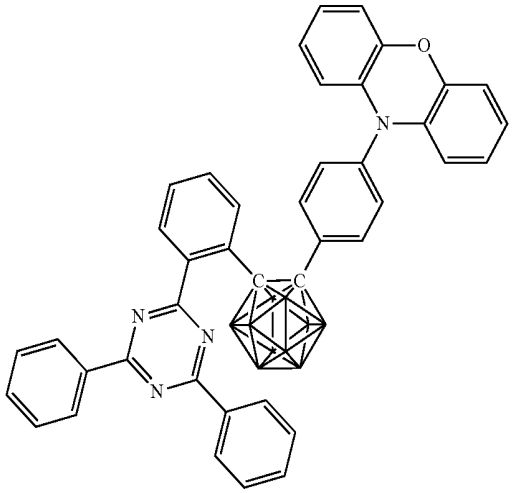

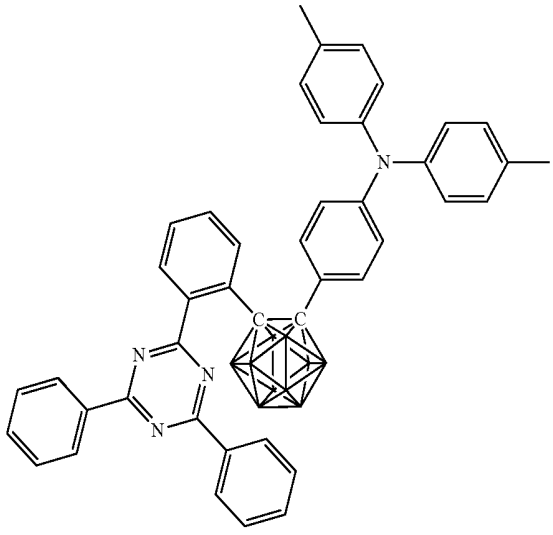

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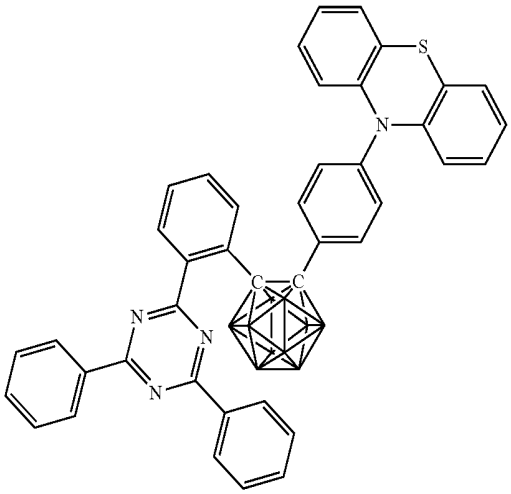

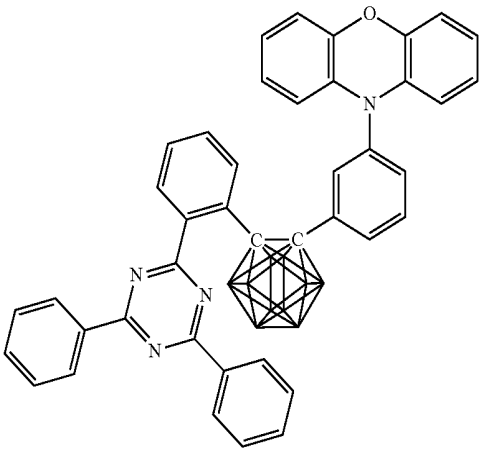

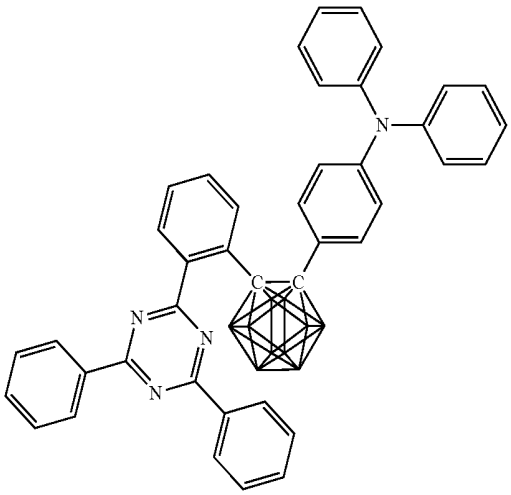

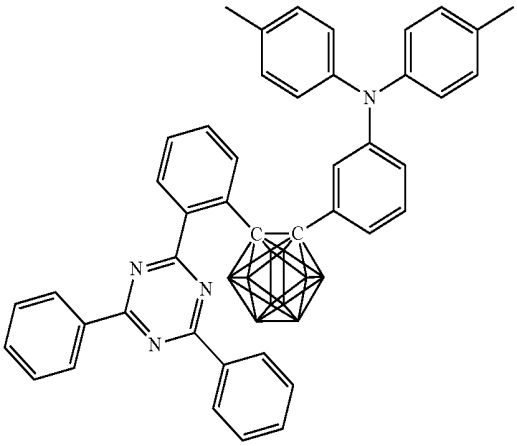

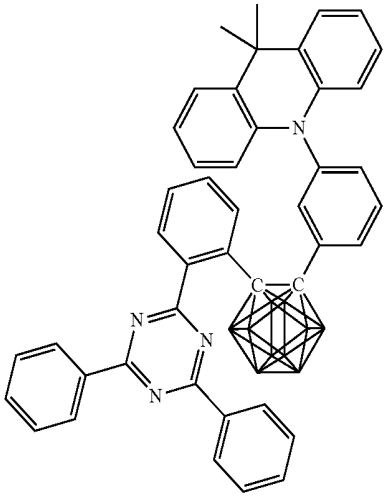

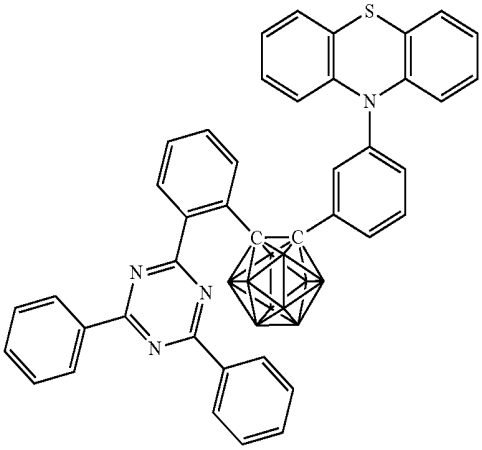

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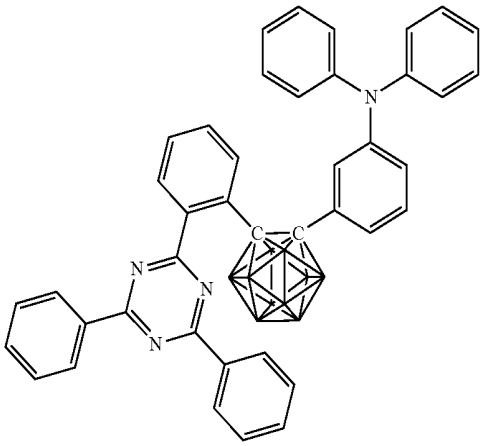

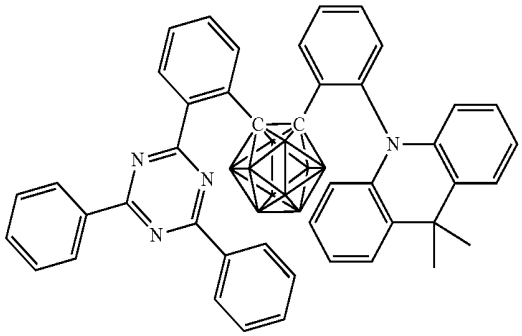

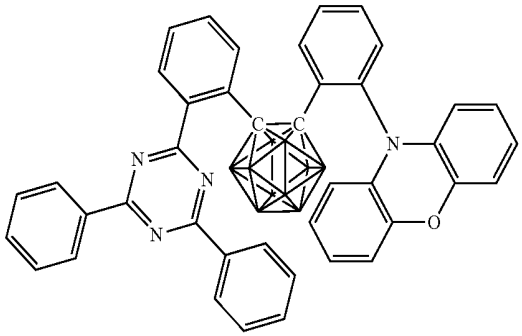

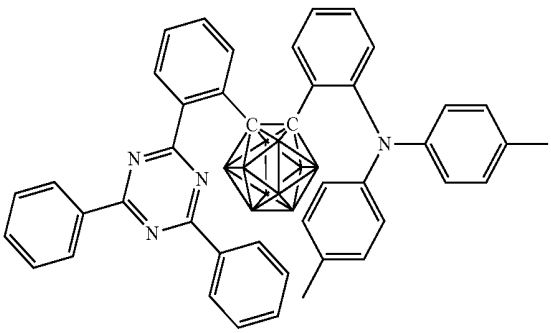

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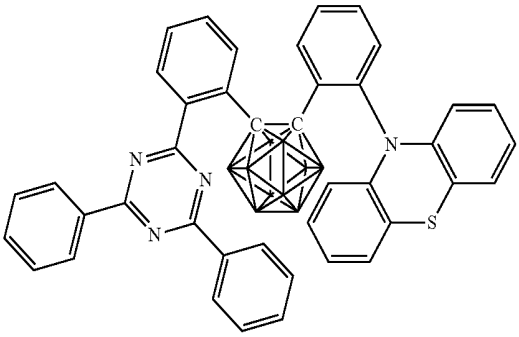

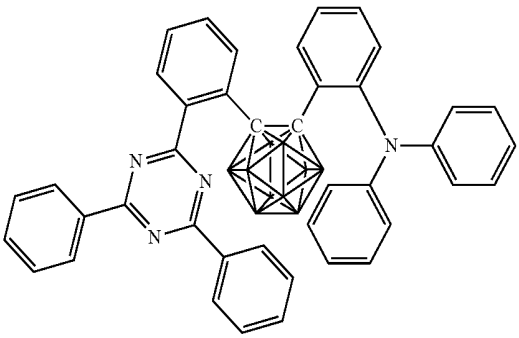

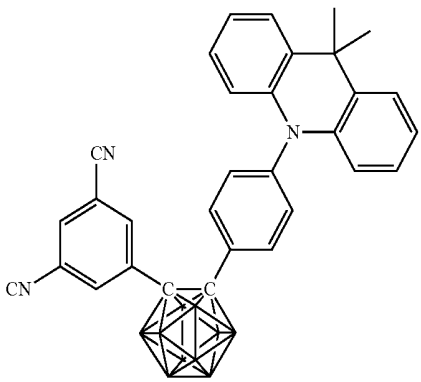

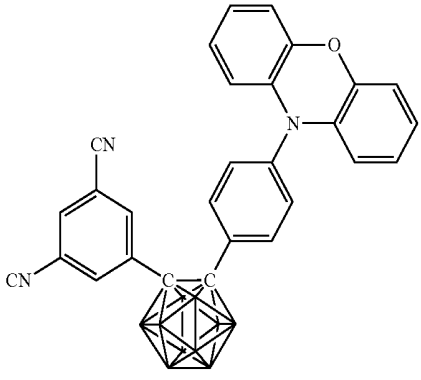

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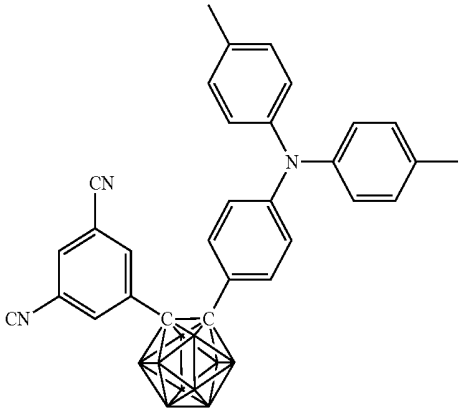

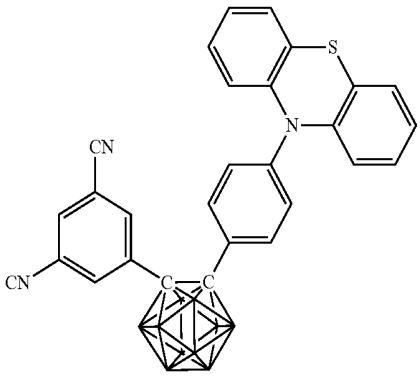

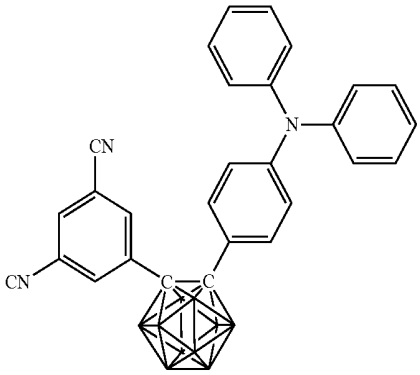

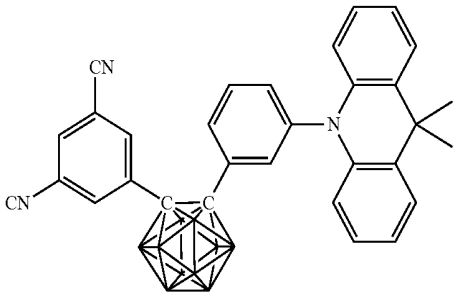

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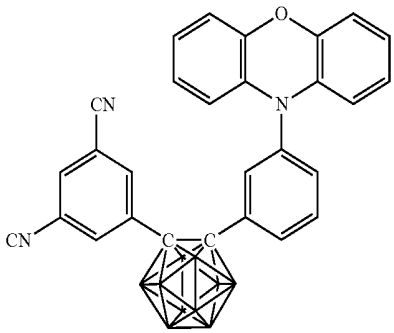

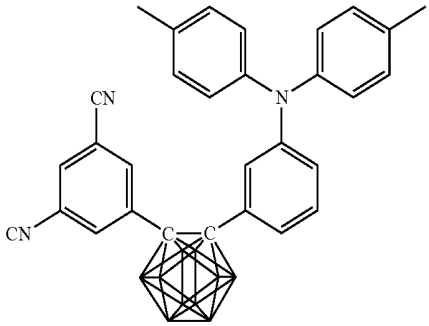

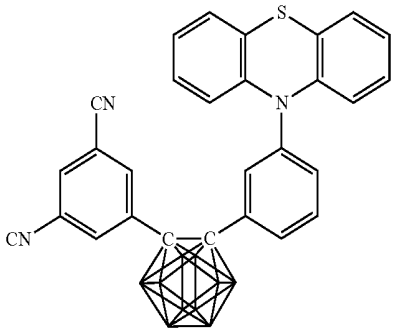

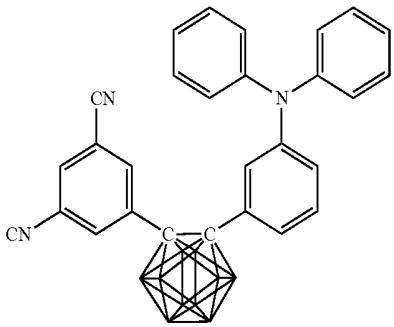

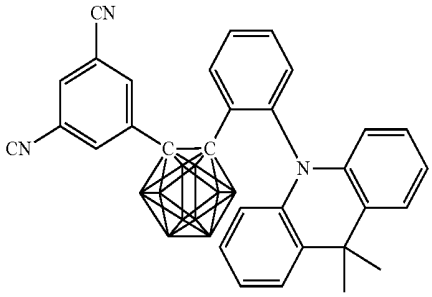

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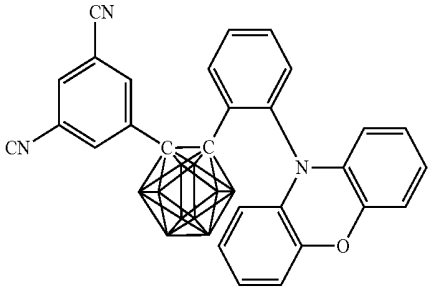

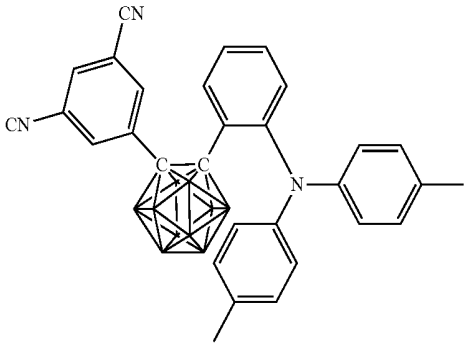

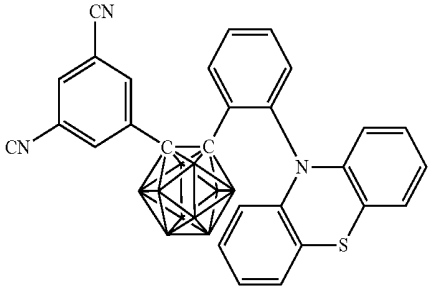

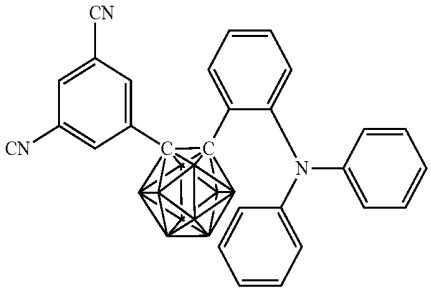

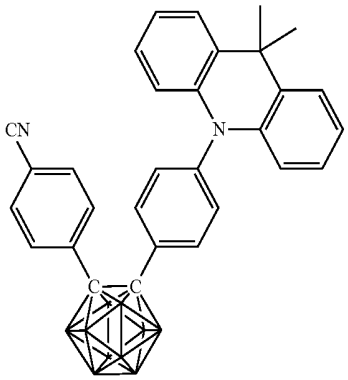

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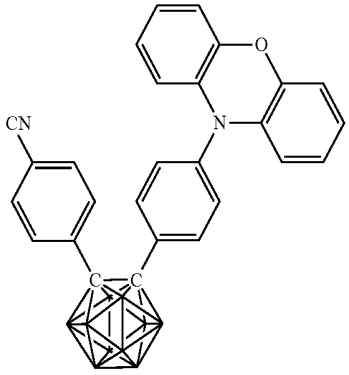

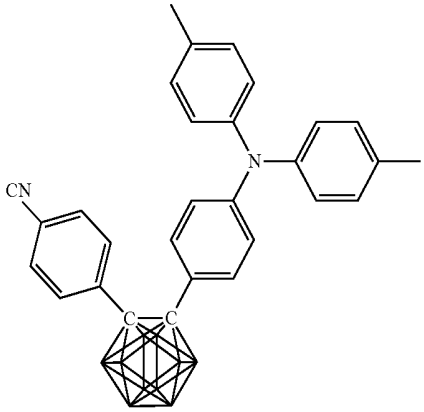

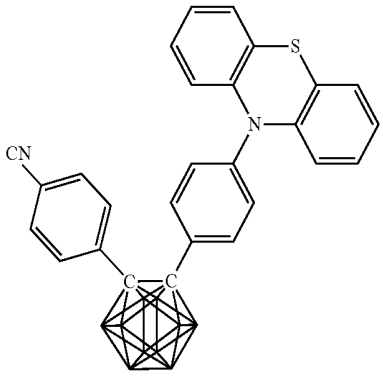

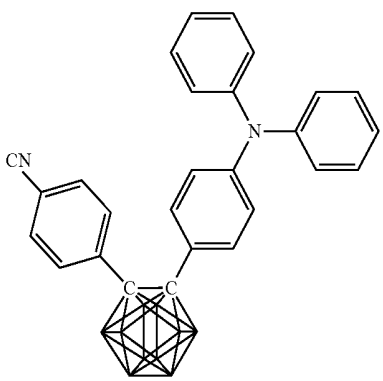

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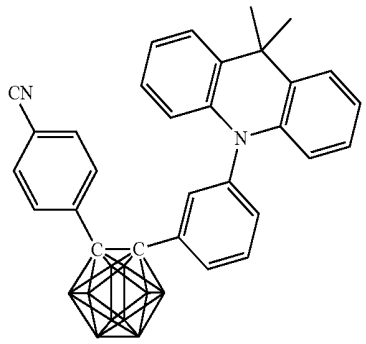

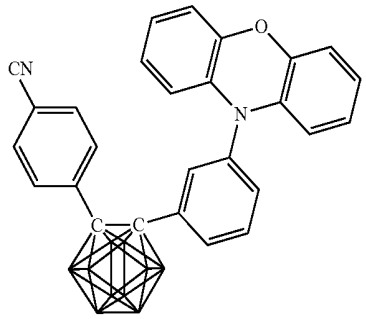

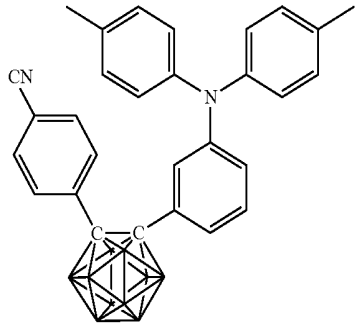

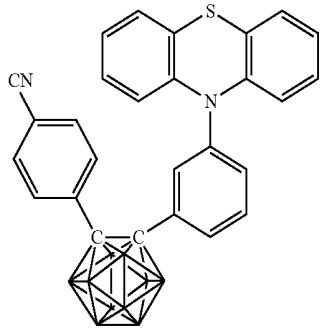

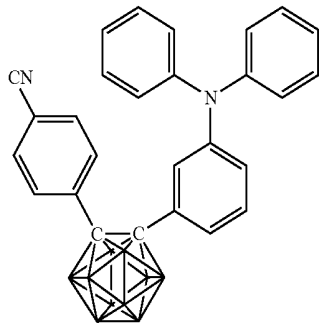

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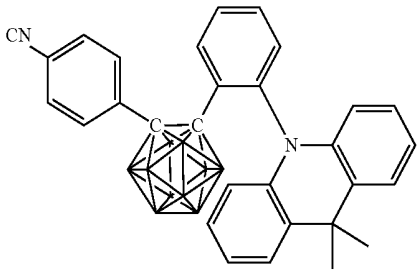

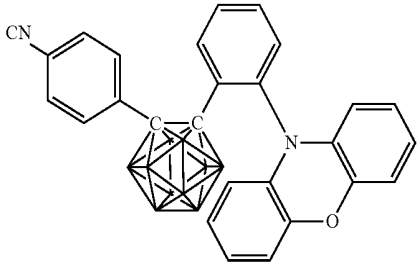

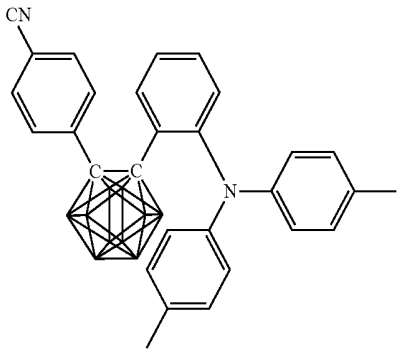

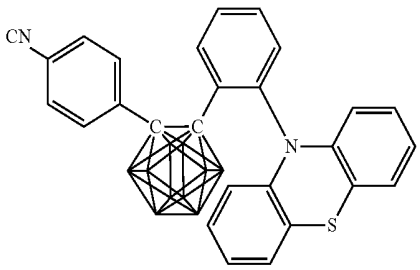

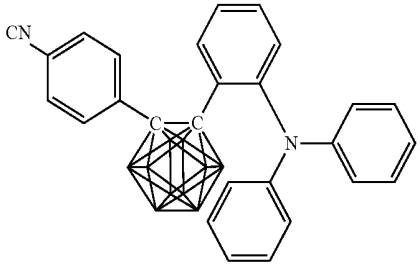

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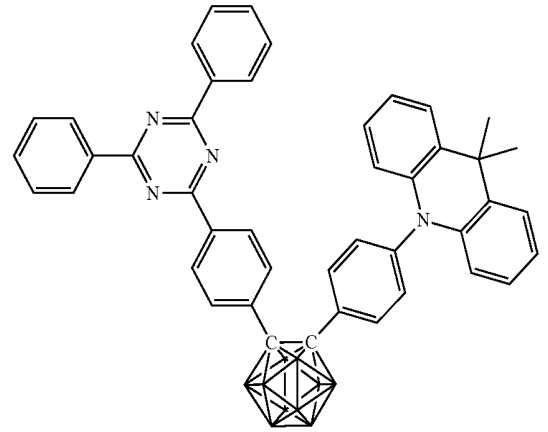

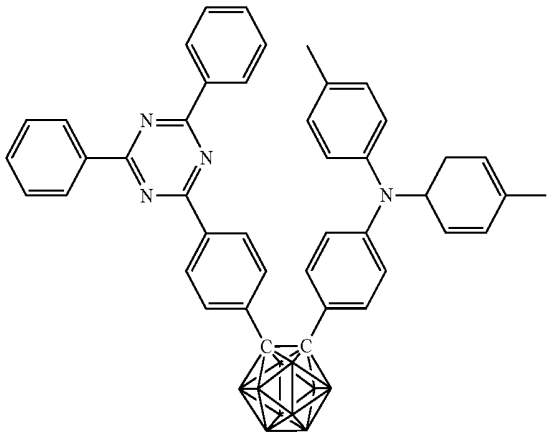

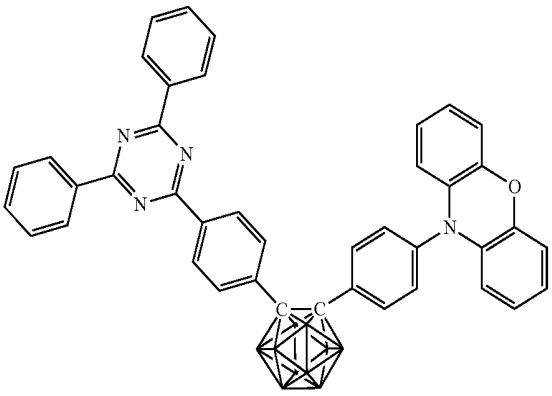

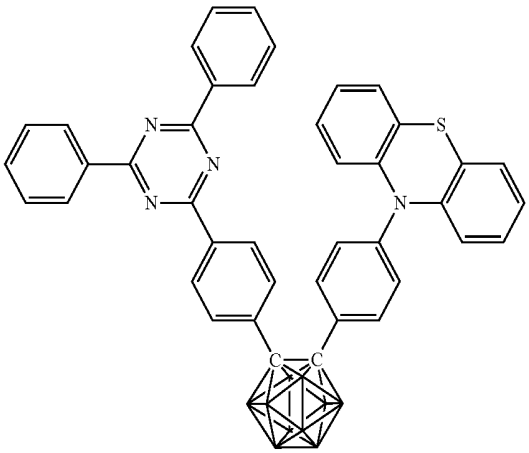

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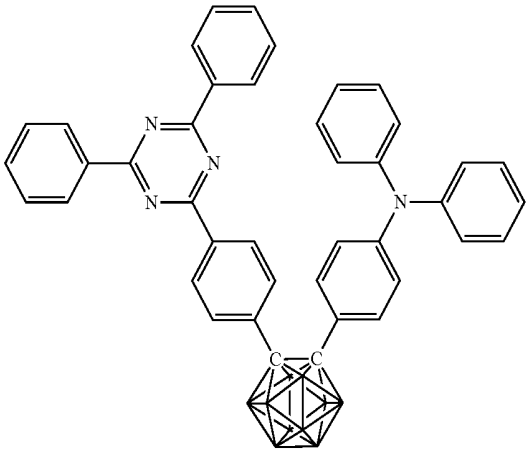

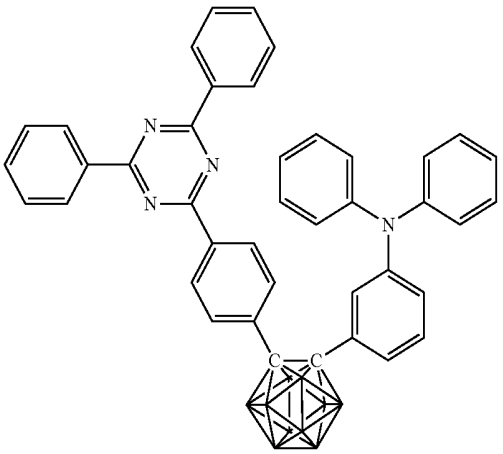

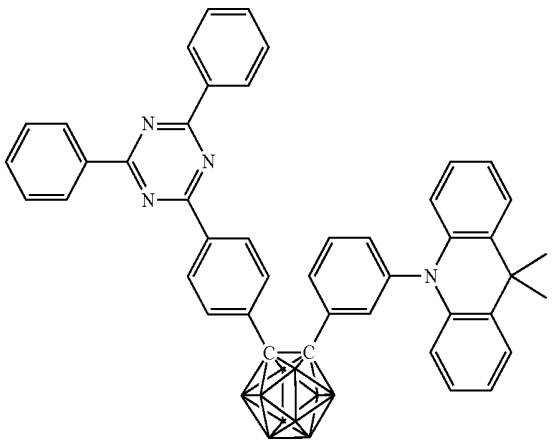

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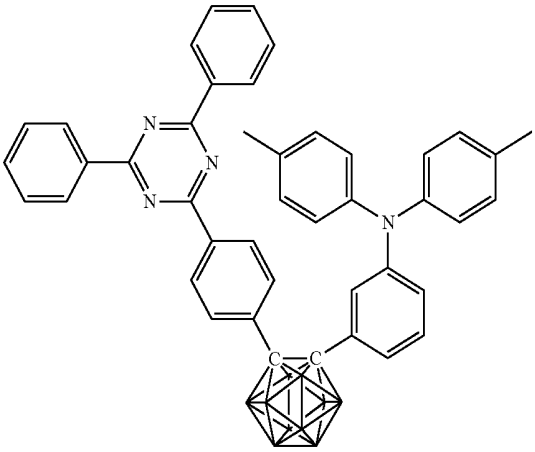

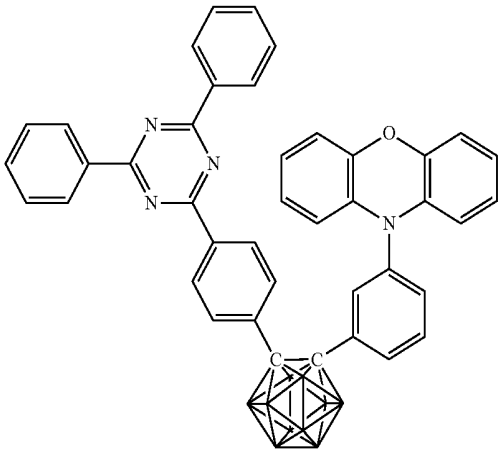

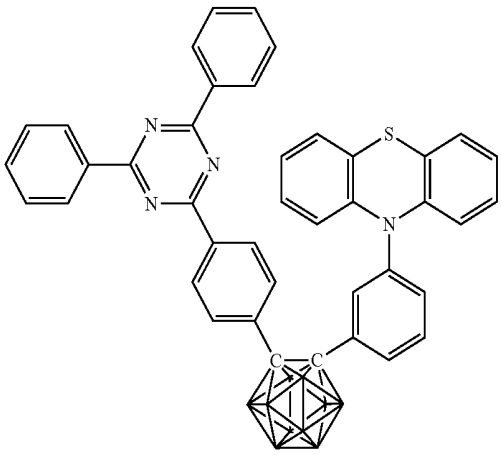

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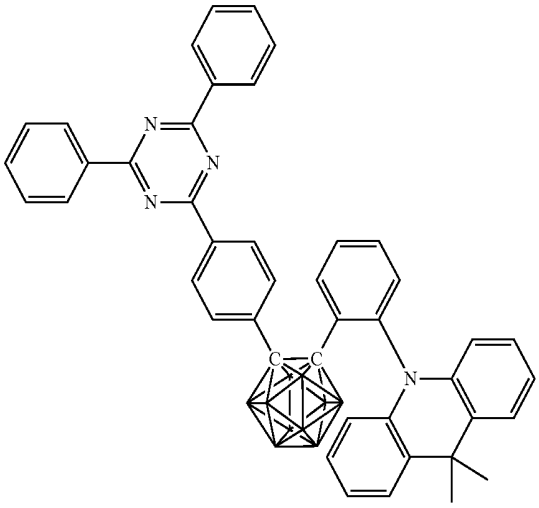

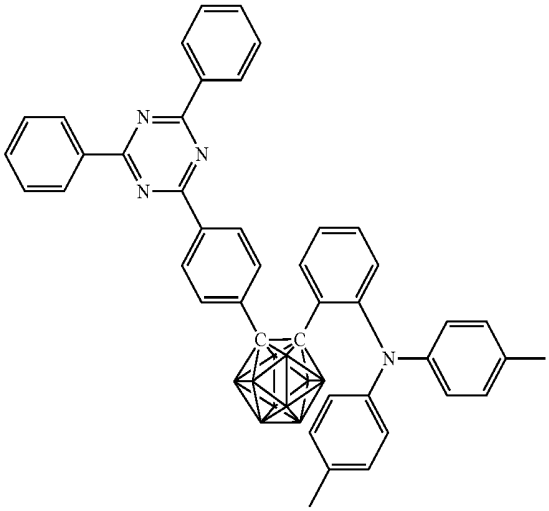

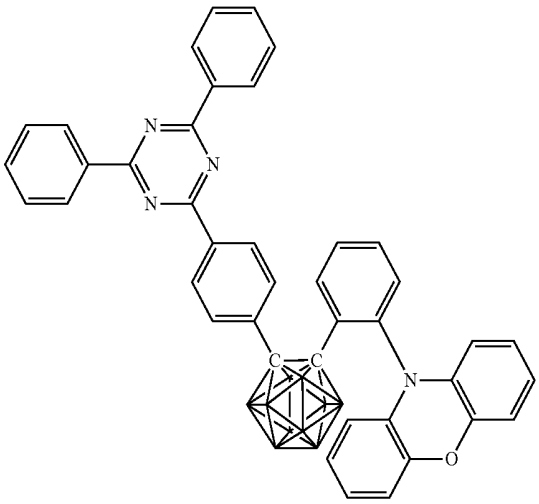

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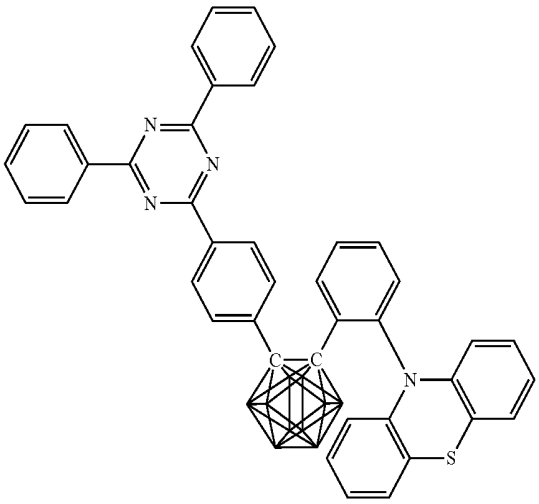

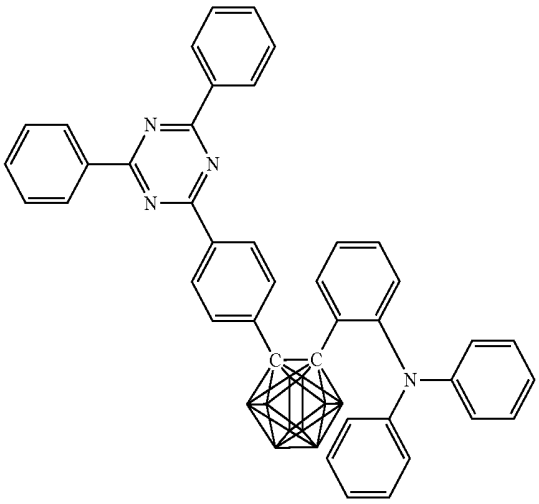

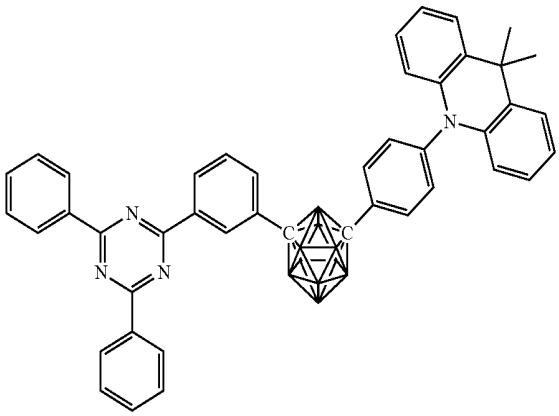

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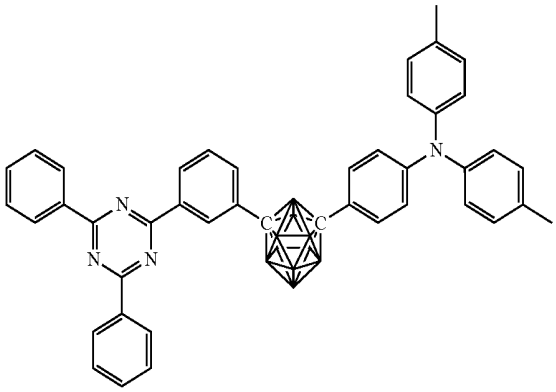

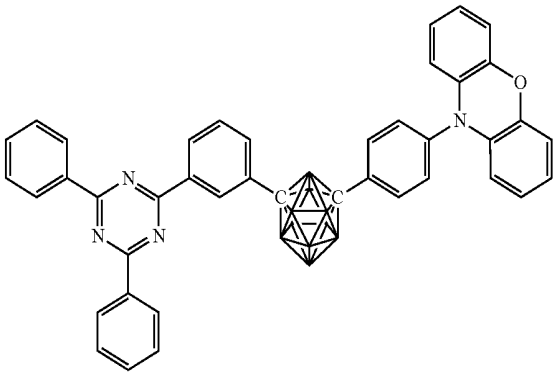

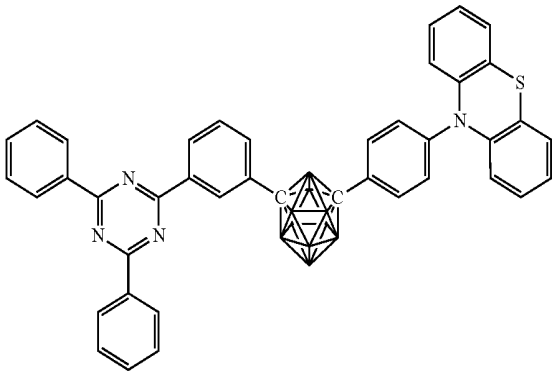

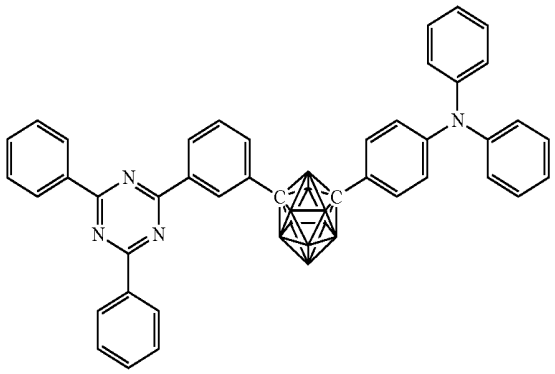

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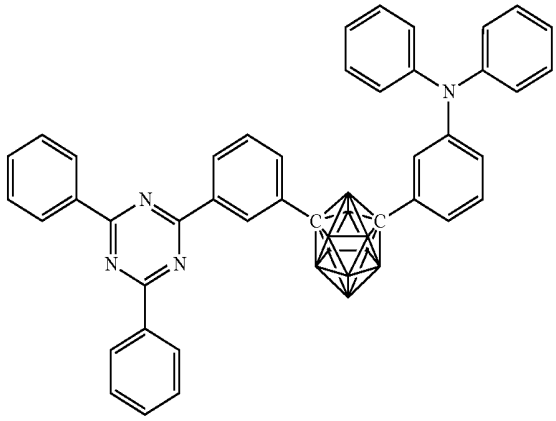

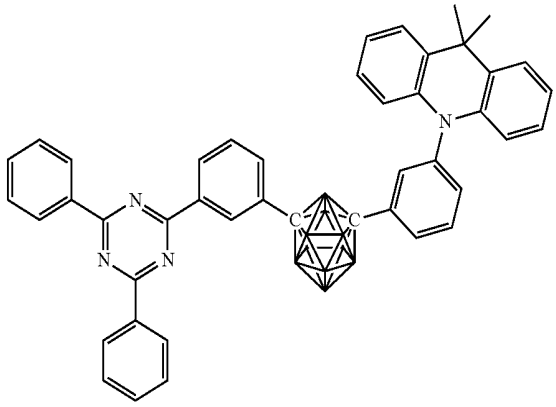

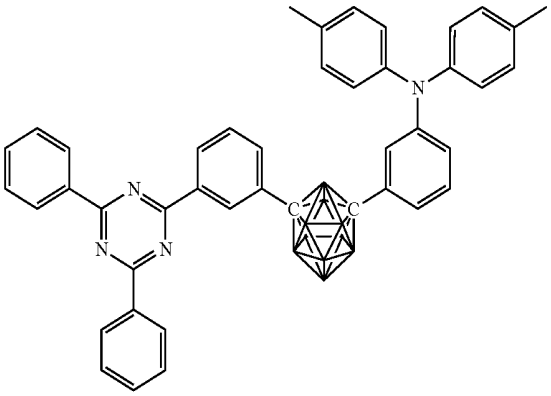

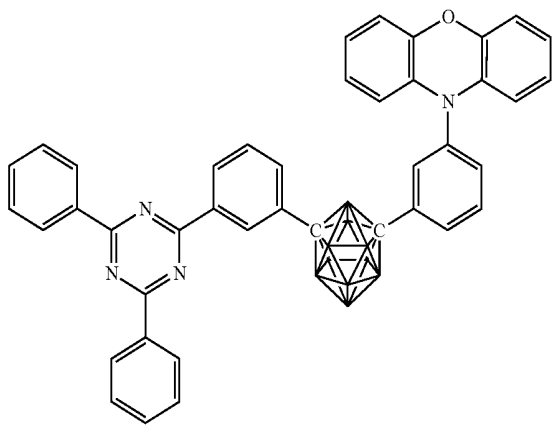

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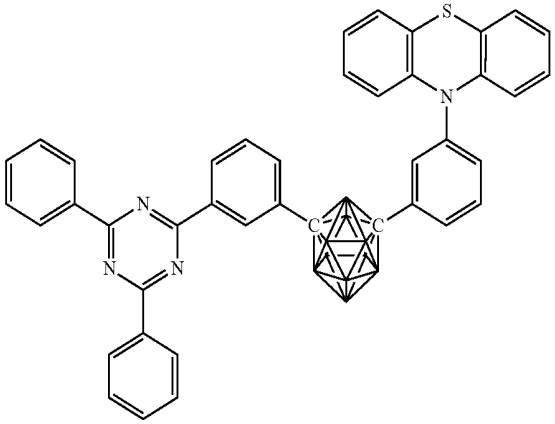

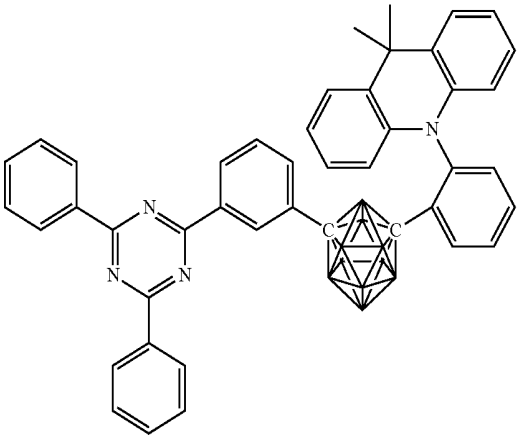

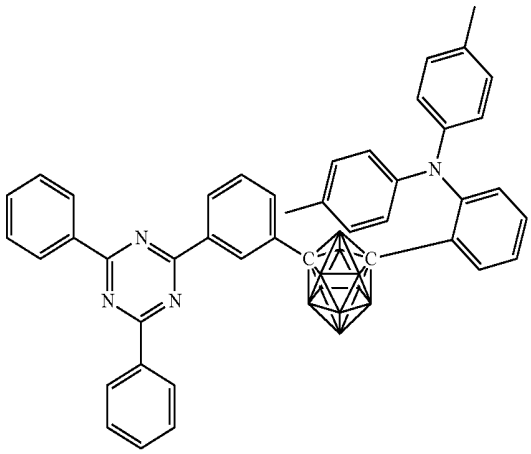

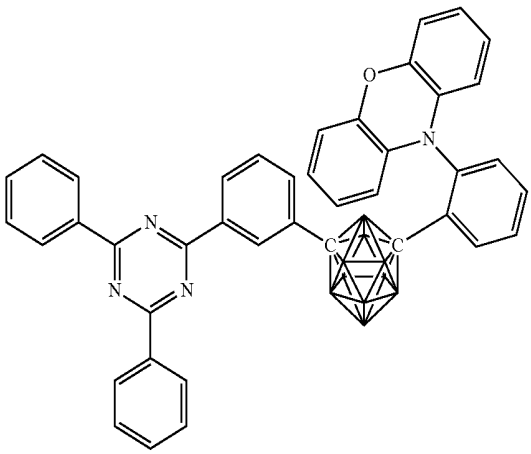

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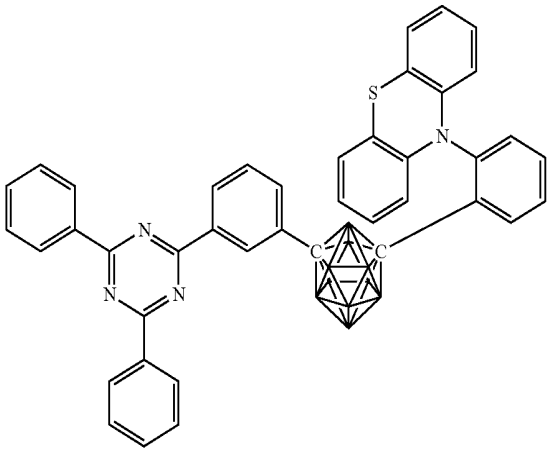

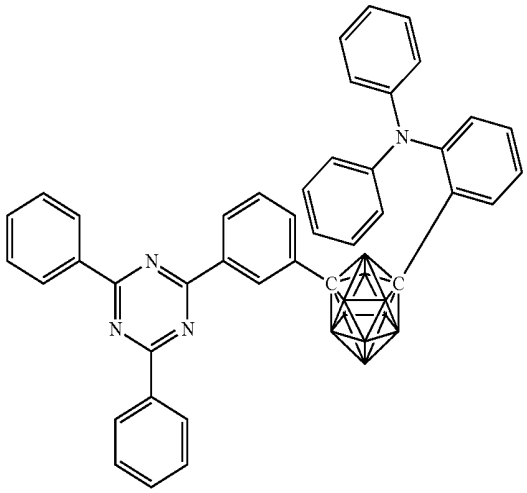

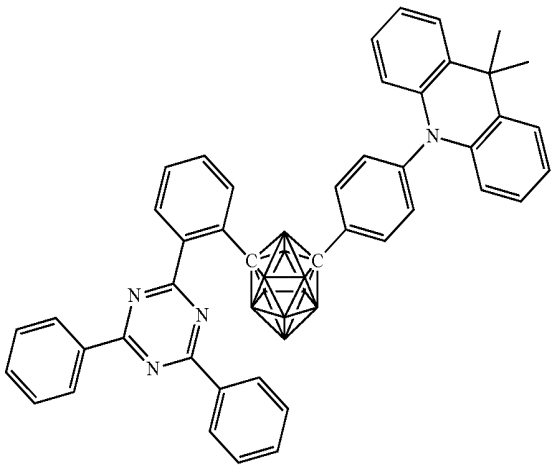

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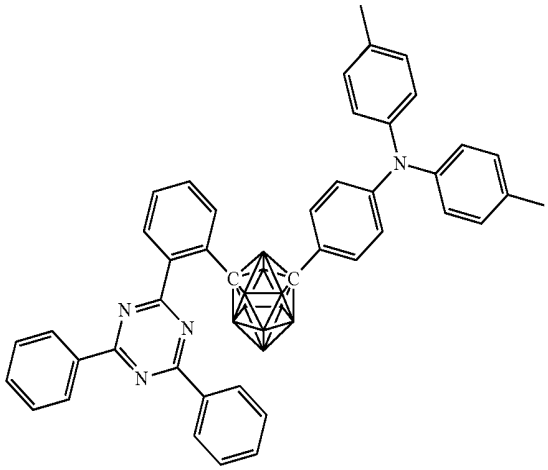

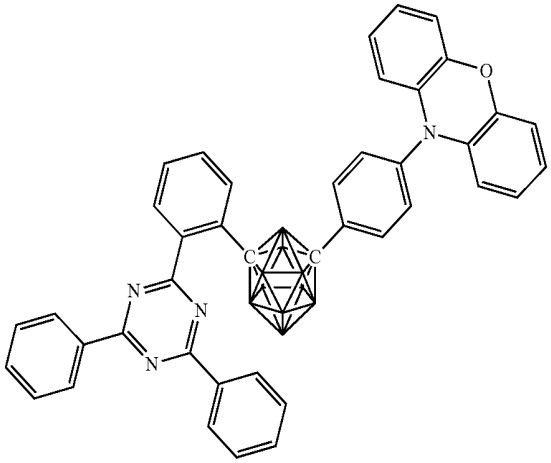

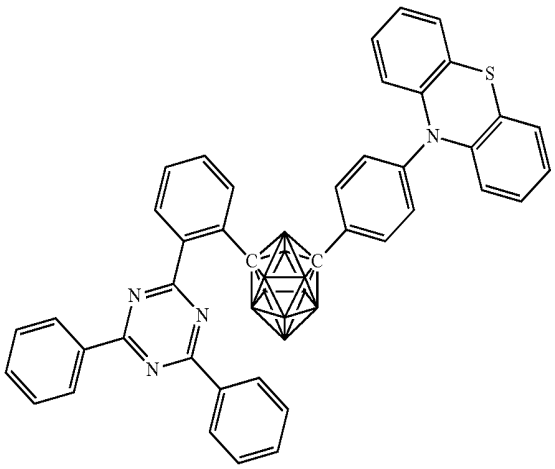

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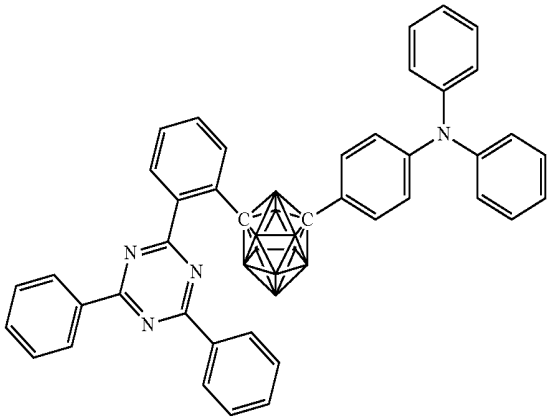

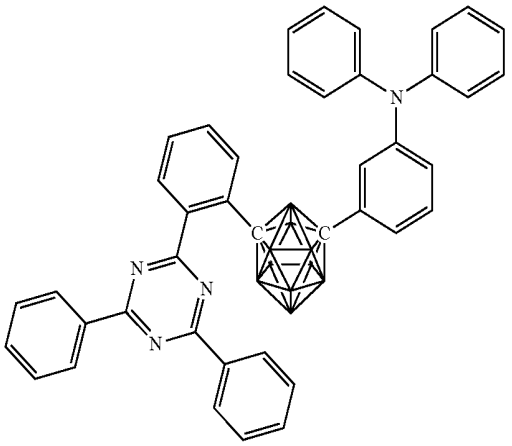

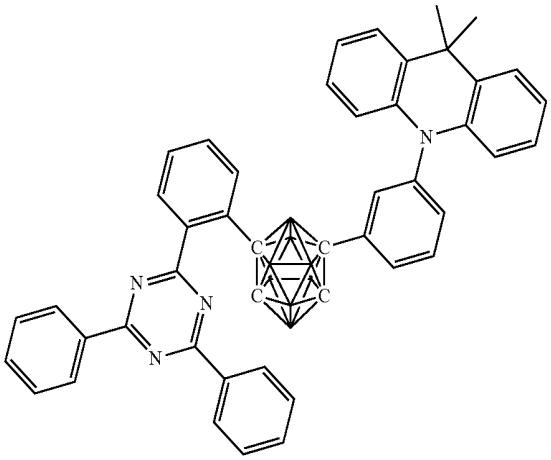

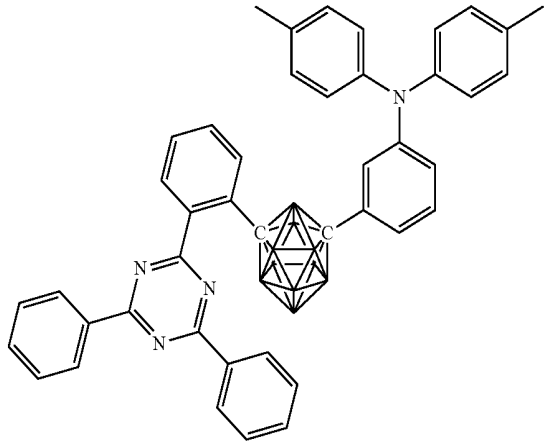

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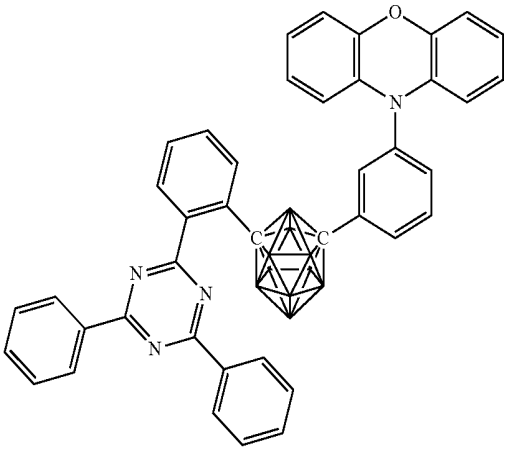

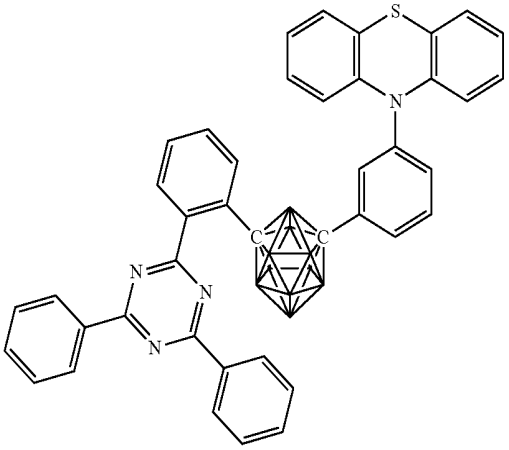

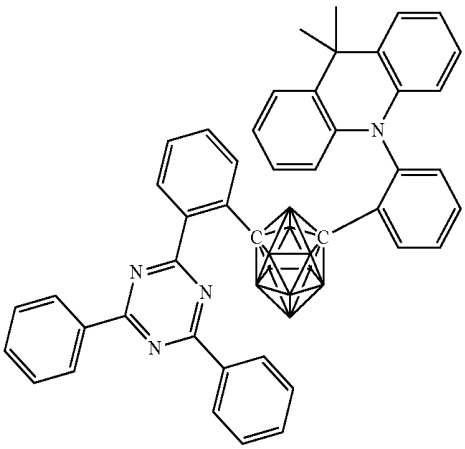

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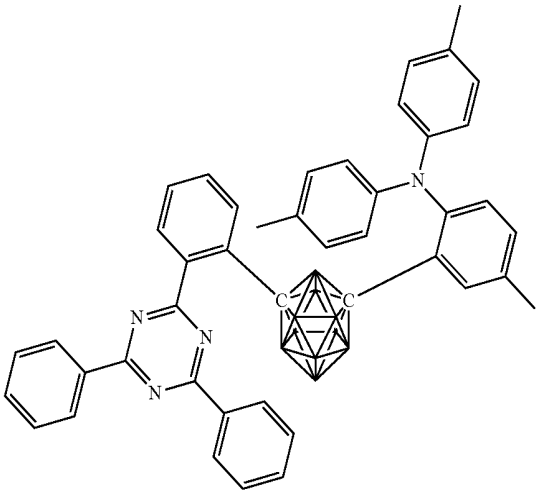

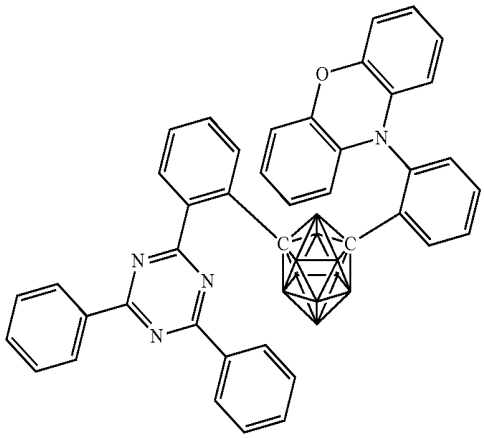

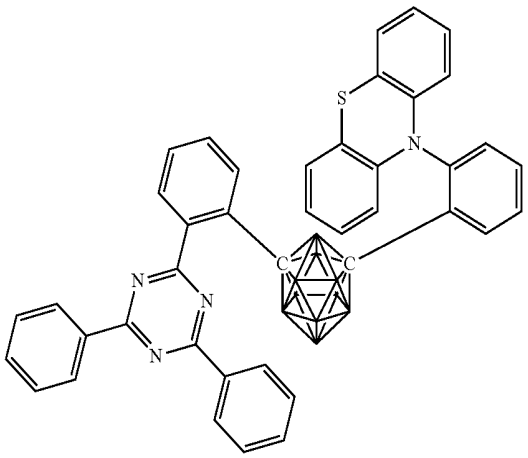

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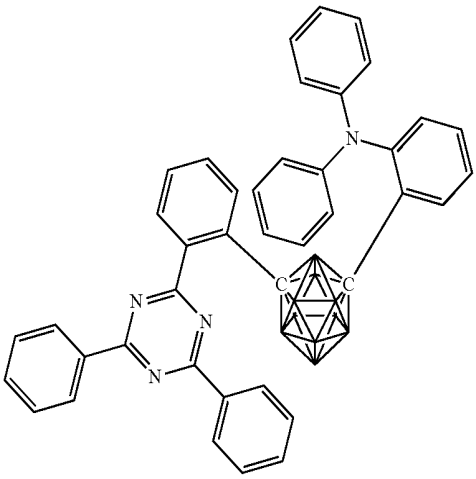

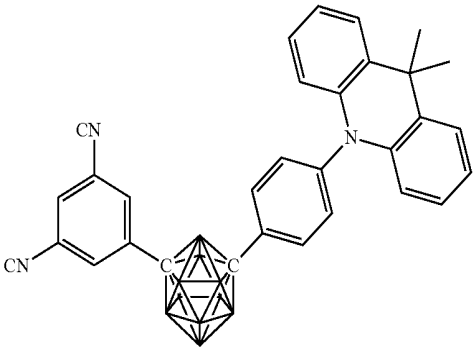

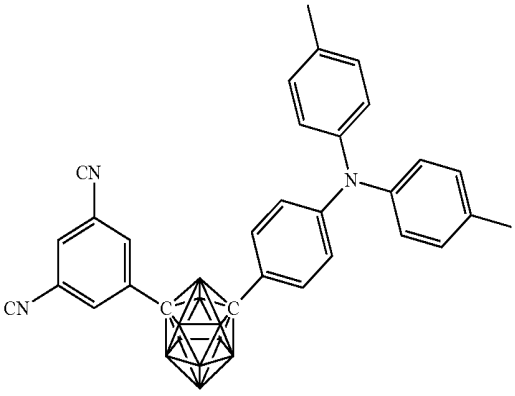

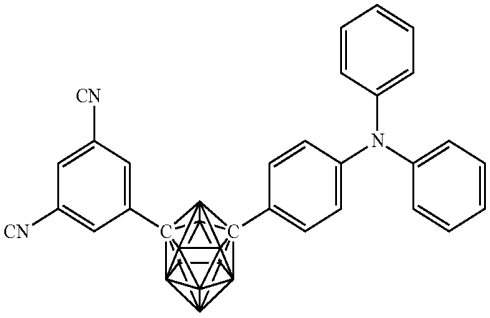

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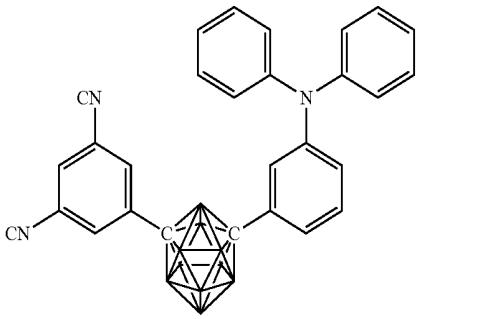

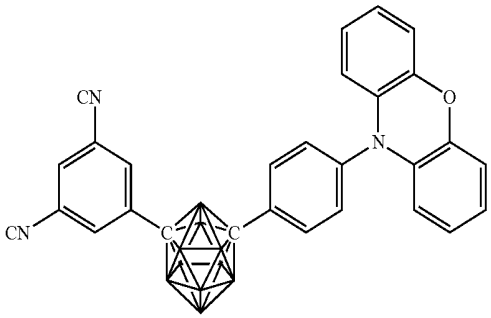

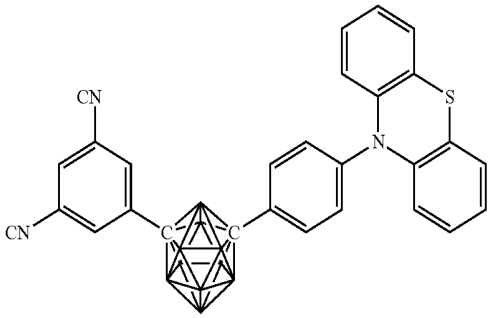

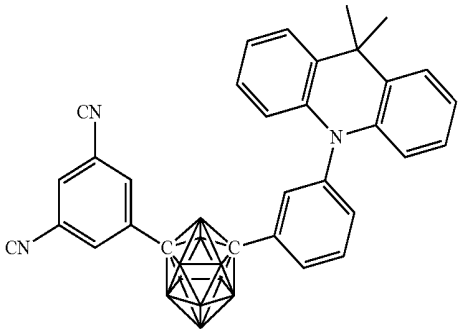

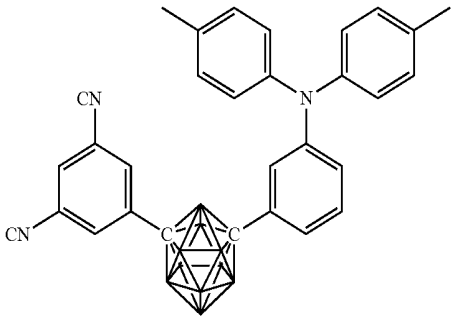

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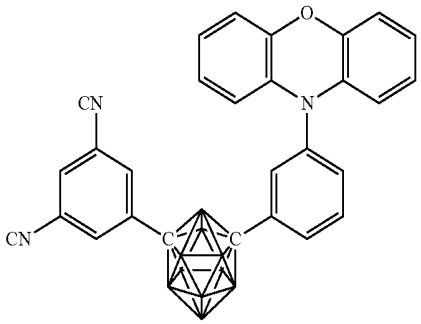

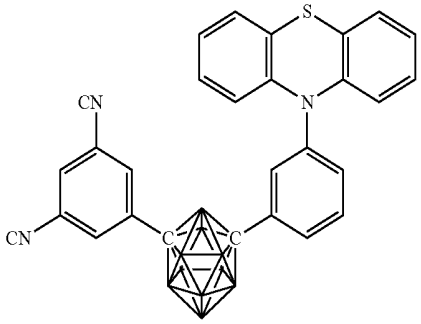

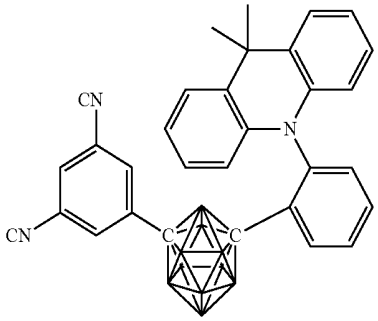

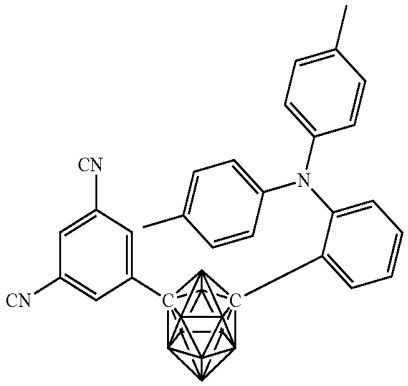

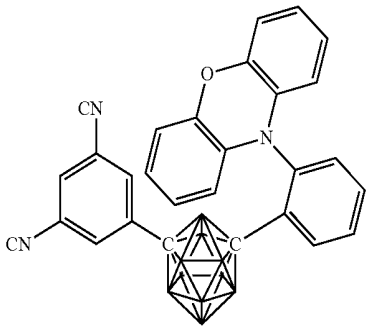

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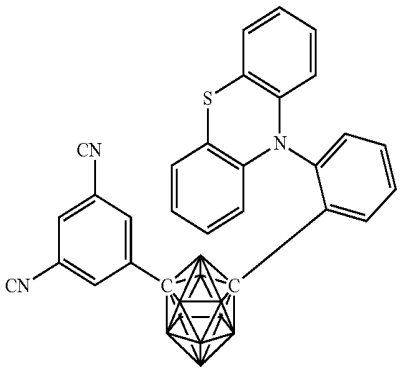

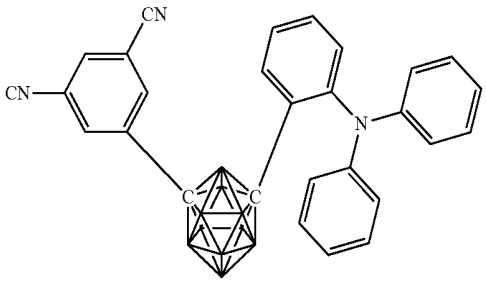

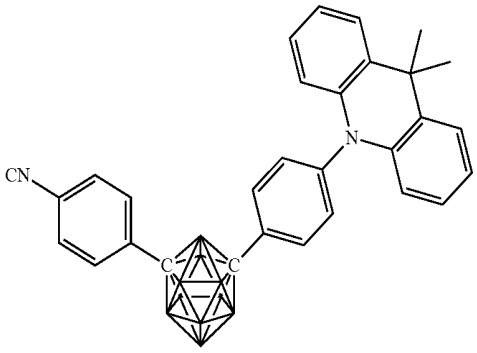

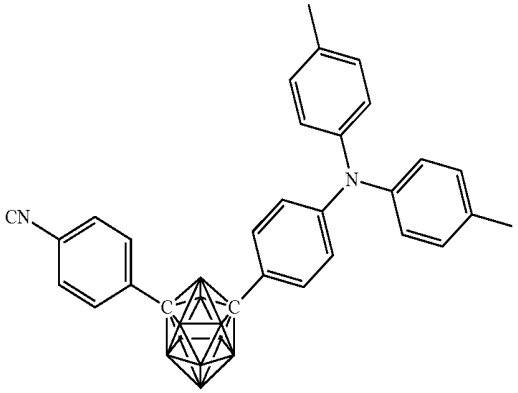

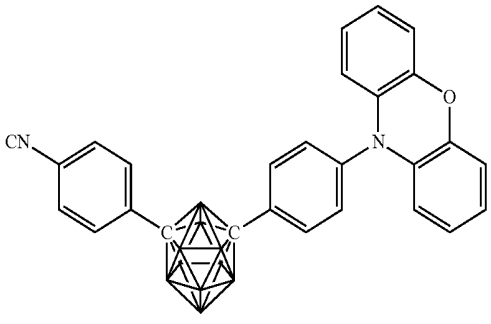

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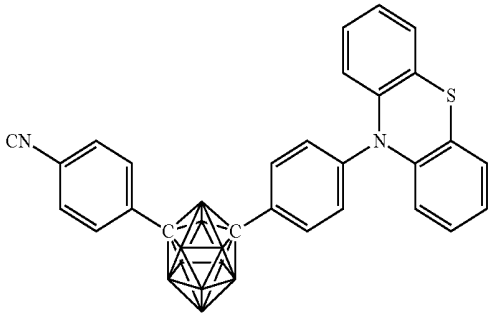

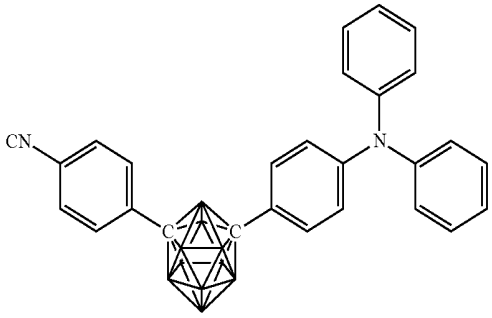

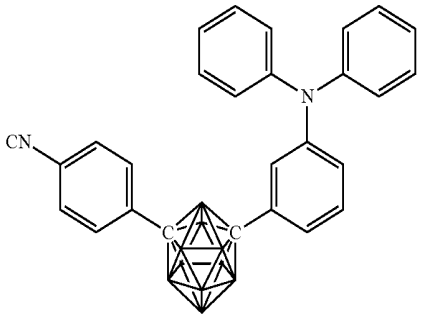

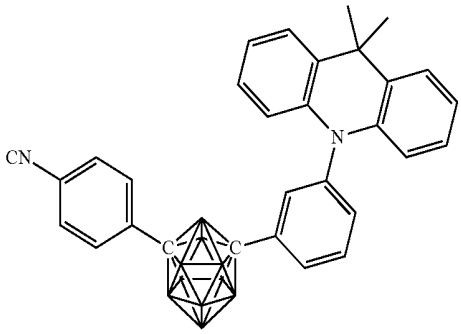

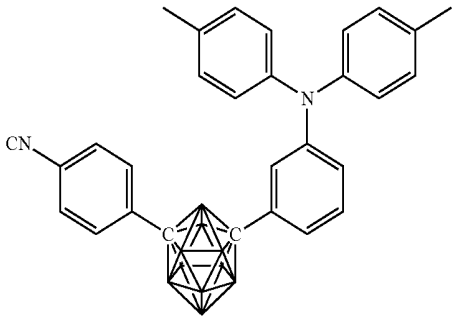

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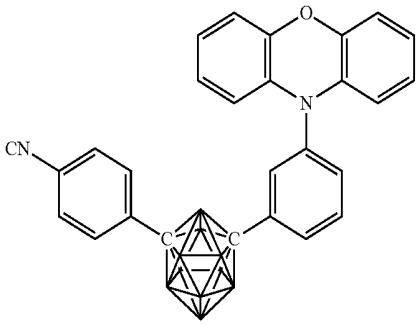

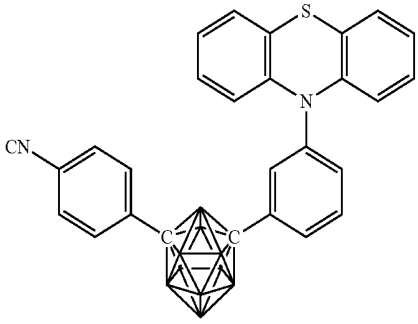

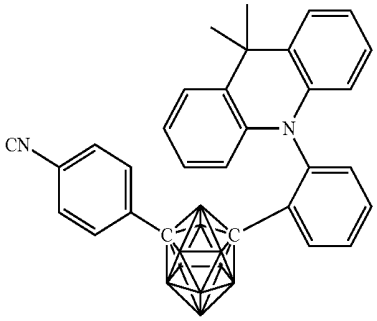

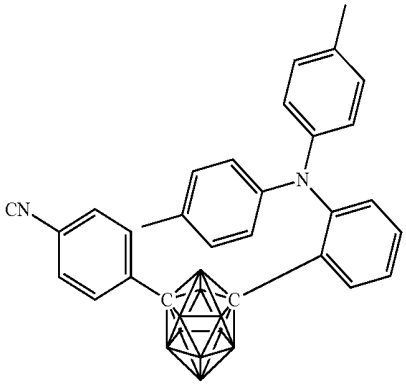

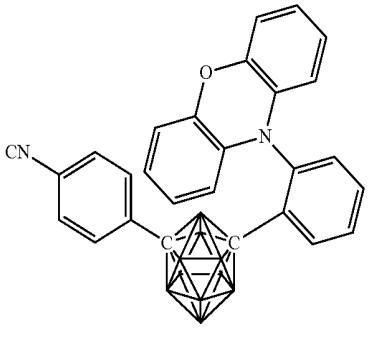

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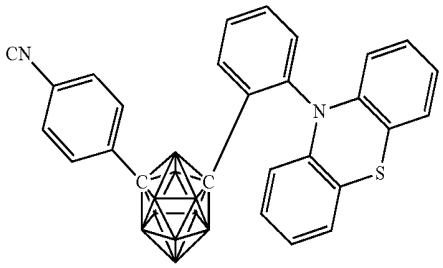

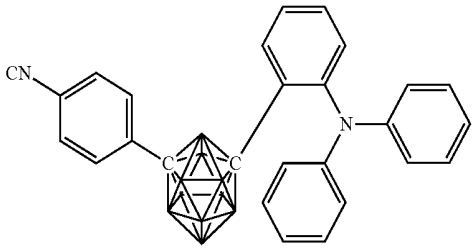

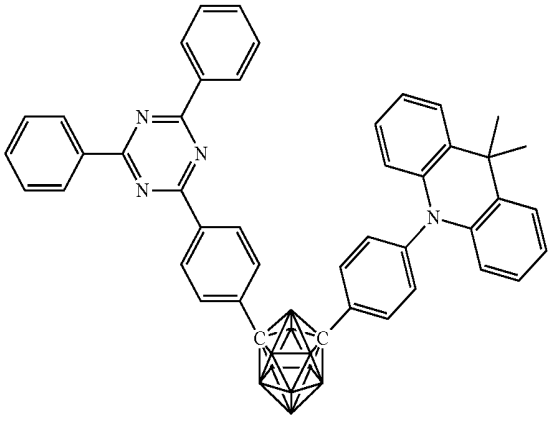

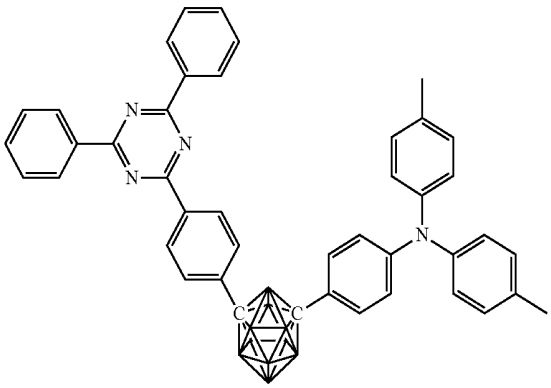

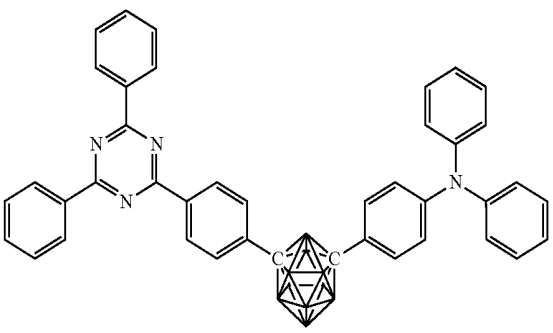

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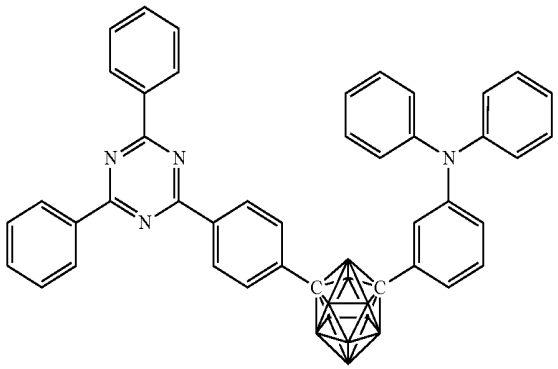

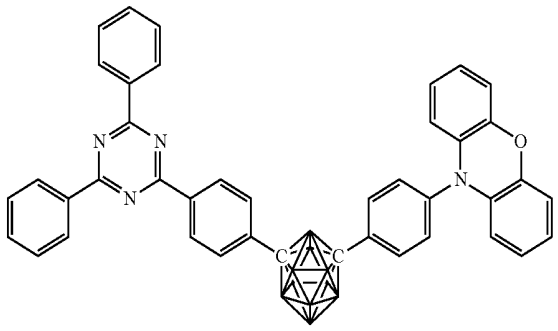

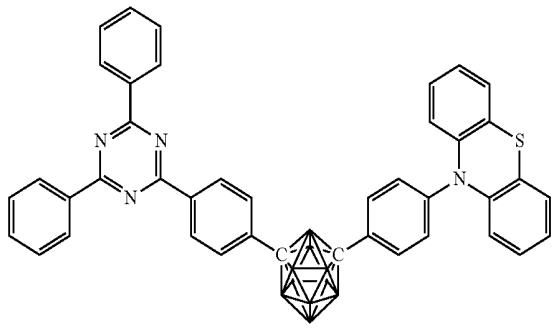

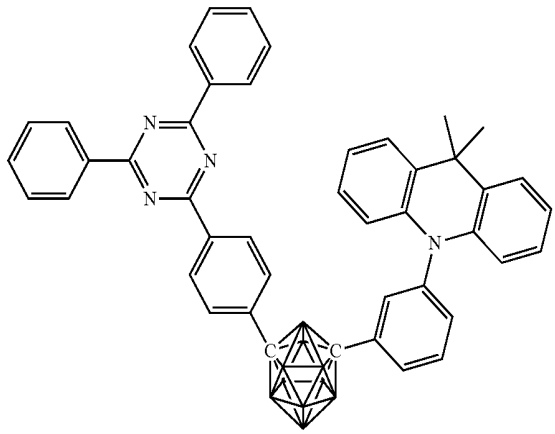

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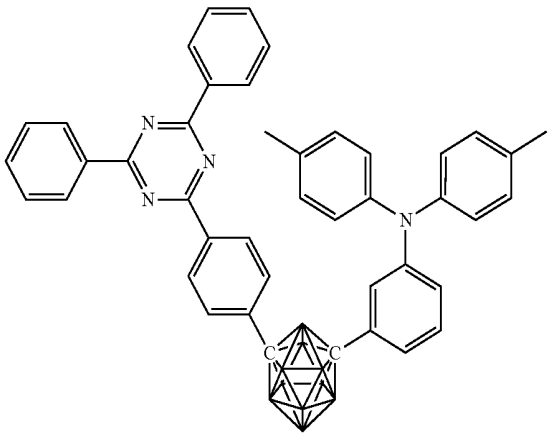

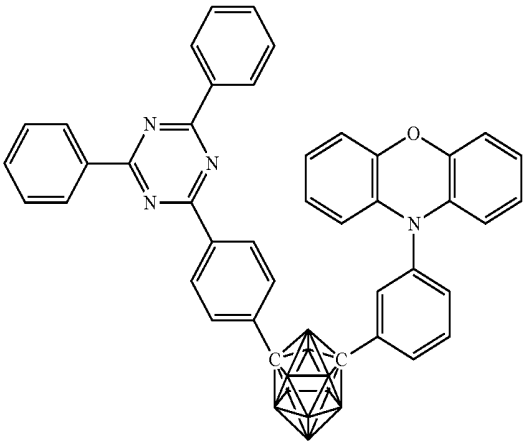

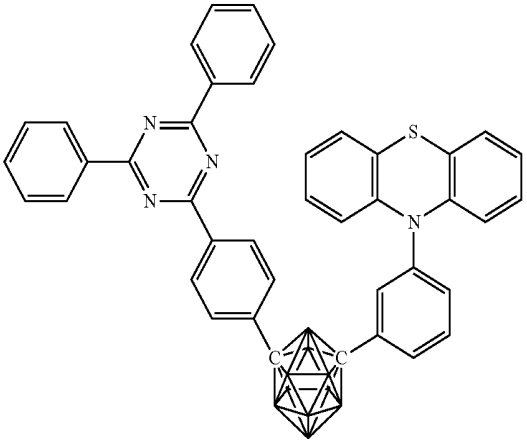

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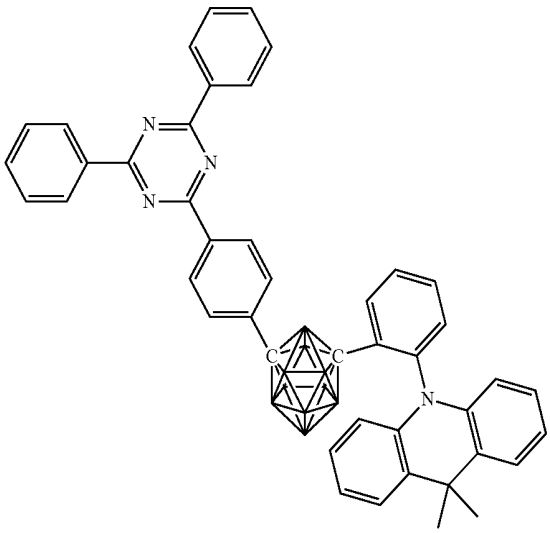

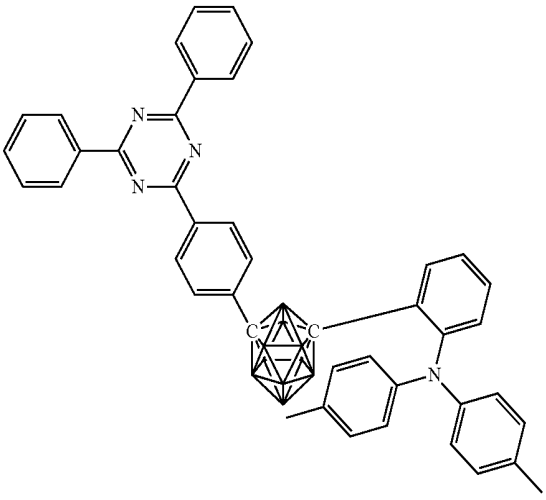

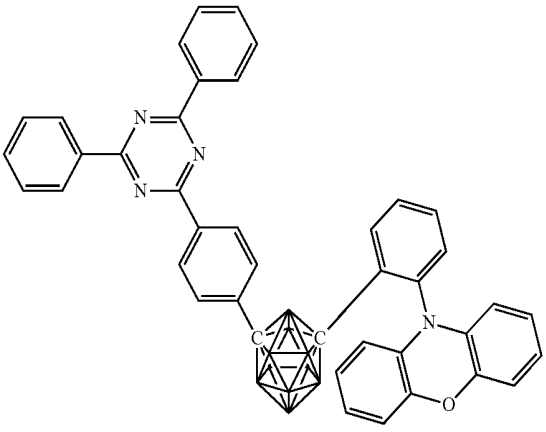

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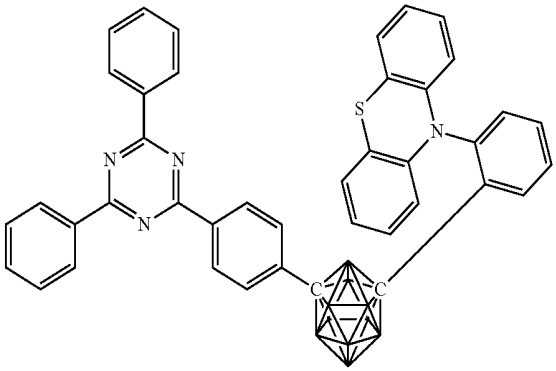
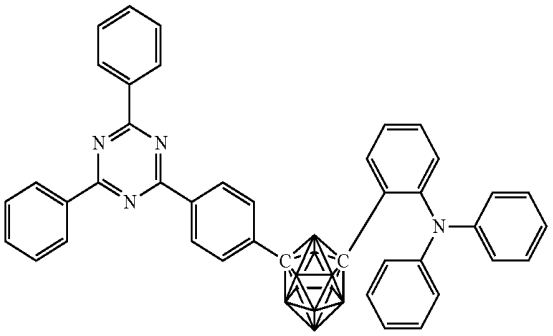




[0066] The molecular weight of the compound represented by the general formula (1) is preferably 1,500 or less, more preferably 1,200 or less, and further preferably 1,000 or less, for example, in the case where an organic layer containing the compound represented by the general formula (1) is intended to be formed as a film by a vapor deposition method. The lower limit of the molecular weight is the molecular weight of the smallest compound represented by the general formula (1).

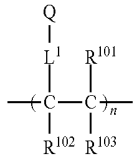
[0067] The compound represented by the general formula (1) may be formed into a film by a coating method irrespective of the molecular weight thereof. The compound that has a relatively large molecular weight may be formed into a film by a coating method.

[0068] As an application of the invention, it may be considered that a compound that contains plural structures each represented by the general formula (1) in the molecule is used as a host material or a light-emitting material.

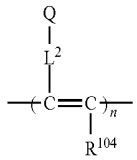
[0069] For example, it may be considered that a polymerizable group is introduced in advance to the structure represented by the general formula (1), and a polymer obtained by polymerizing the polymerizable group is used as a light-emitting material. Specifically, it may be considered that a monomer that has a polymerizable functional group at any of X^1 to X^{12}, A, and D in the general formula (1) is prepared, and is homopolymerized or copolymerized with another monomer to prepare a polymer containing repeating units, and the polymer is used as a host material or a light-emitting material. In alternative, it may be considered that the compounds represented by the general formula (1) are reacted to form a dimer or a trimer, and the dimer or the trimer is used as a light-emitting material.

[0070] Examples of the polymer having the repeating unit containing the structure represented by the general formula (1) include a polymer containing a structure represented by the following general formula (4) or (5).

General Formula (4)



General Formula (5)



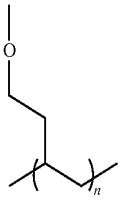
[0071] In the general formulae (4) and (5), Q represents a group containing the structure represented by the general formula (1), and L^1 and L^2 each represent a linking group. The linking group preferably has from 0 to 20 carbon atoms, more preferably from 1 to 15 carbon atoms, and further preferably from 2 to 10 carbon atoms. The linking group preferably has a structure represented by —X^{101}-L^{11}-, wherein X^{101} represents an oxygen atom or a sulfur atom, and preferably an oxygen atom, and L^{11} represents a linking group, preferably a substituted or unsubstituted alkylene group or a substituted or unsubstituted arylene group, and more preferably a substituted or unsubstituted alkylene group having from 1 to 10 carbon atoms or a substituted or unsubstituted phenylene group.

[0072] In the general formulae (4) and (5), R^{101}, R^{102}, R^{103} and R^{104} each independently represent a substituent, preferably a substituted or unsubstituted alkyl group having from 1 to 6 carbon atoms, a substituted or unsubstituted alkoxy group having from 1 to 6 carbon atoms, or a halogen atom, more preferably an unsubstituted alkyl group having from 1 to 3 carbon atoms, an unsubstituted alkoxy group having from 1 to 3 carbon atoms, a fluorine atom or a chlorine atom, and further preferably an unsubstituted alkyl group having from 1 to 3 carbon atoms or an unsubstituted alkoxy group having from 1 to 3 carbon atoms.

[0073] The linking group represented by L^1 and L^2 may be bonded to any of X^1 to X^{12}, A, and D of the structure of the general formula (1), any of R^1, R^2 and Ar^1 of the structure of the general formula (2), and any of Het and Ara of the structure of the general, formula (3), constituting Q. Two armors of the linking groups may be boded to one group represented by Q to form a crosslinked structure or a network structure.

[0074] Specific examples of the structure of the repeating unit include structures represented by the following formulae (6) to (9).

Formula (6)



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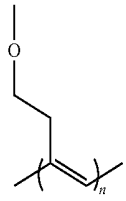
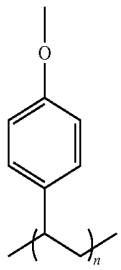
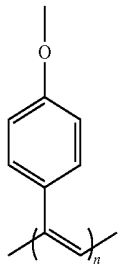
Formula (7)



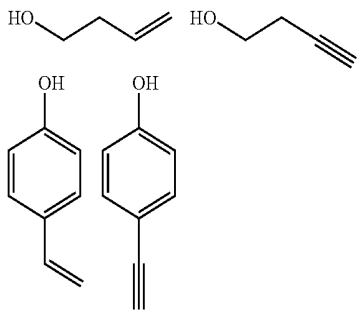
Formula (8)



Formula (9)



[0075] The polymer having the repeating unit containing the structure represented by any of the formulae (6) to (9) may be synthesized in such a manner that a hydroxy group is introduced to any of X^1 to X^{12}, A, and D in the structure represented by the general formula (1), and the hydroxy group as a linker is reacted with the following compound to introduce a polymerizable group thereto, followed by polymerizing the polymerizable group.



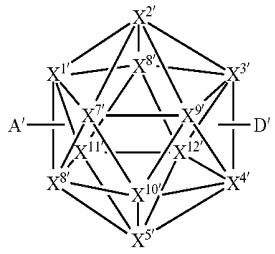
[0076] The polymer containing the structure represented by the general formula (1) in the molecule may be a polymer containing only a repeating unit having the structure represented by the general formula (1), or a polymer further containing a repeating unit having another structure. The repeating unit, having the structure represented by the general formula (1) contained in the polymer may be only one kind or two or more kinds. Examples of the repeating unit that does not have the structure represented by the general formula (1) include a repeating unit derived from a monomer that is used for ordinary copolymerization. Examples of

the repeating unit include a repeating unit derived from a monomer having an ethylenic unsaturated bond, such as ethylene and styrene.

Compound Represented by General Formula (1)

[0077] The compound represented by the general formula (1') is a novel compound.

General Formula (1')

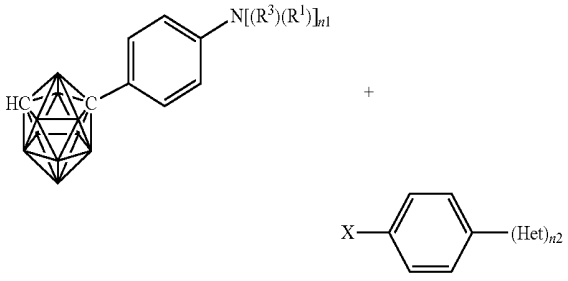


[0078] In the general formula (1), $X^{1'}$ to $X^{12'}$ each independently represent C or BH constituting carborane, provided that among $X^{1'}$ to $X^{12'}$, the bonding positions to A' and D' each represent C, and the other thereof each represent BH; A' represents an acceptor bonded to the carborane through an aromatic ring or a heteroaromatic ring; and D' represents a donor bonded to the carborane through an aromatic ring or a heteroaromatic ring.

[0079] For the descriptions and the preferred ranges of $X^{1'}$ to $X^{12'}$, A', and D', reference may be made to the descriptions of the compound represented by the general formula (1).

Synthesis Method of Compound Represented by General Formula (1')

[0080] The compound represented by the general formula (1') may be synthesized by combining the known reactions. For example, a compound represented by the general formula (1'), in which $X^{1'}$ represents a group represented by the general formula (3), $X^{3'}$ represents a group represented by the general formula (2), and Ar^1 and Ar^2 each represent a phenylene group, can be synthesized by reacting the following two compounds.



[0081] For the descriptions of R^1, R^2, Het, n1, and n2 in the aforementioned reaction scheme, reference may be made to the corresponding descriptions in the general formulae (2) and (3). X represents a halogen atom, examples of which include a fluorine atom, a chlorine atom, a bromine atom, and an iodine atom, and a chlorine atom, a bromine atom, and an iodine atom are preferred.

[0082] The reactions in the aforementioned scheme each are an application of the known reactions, and the known reaction conditions may be appropriately selected and used. For the details of the reactions, reference may be made to the synthesis examples described later. The compound represented by the general formula (1') may also be synthesized by combining the other known synthesis reactions.

Organic Light-Emitting Device

[0083] The compound represented by the general formula (1) of the invention is useful as a host material and/or a light-emitting material of an organic light-emitting device. Accordingly, the compound represented by the general formula (1) of the invention may be effectively used as a host material or a light-emitting material in a light-emitting layer of an organic light-emitting device. The compound represented by the general formula (1) includes a delayed fluorescent emitter emitting delayed fluorescent light. Thus, the invention provides an invention relating to a delayed fluorescent emitter having the structure represented by the general formula (1), an invention relating to the use of the compound represented by the general formula (1) as the delayed fluorescent emitter, and an invention relating to a method for emitting delayed fluorescent light with the compound represented by the general formula (1). An organic light-emitting device that uses the compound as a light-emitting material has features that the device emits delayed fluorescent light and has a high light emission efficiency. The principle of the features may be described as follows for an organic electroluminescent device as an example.

[0084] In an organic electroluminescent device, carriers are injected from an anode and a cathode to a light-emitting material to form an excited state for the light-emitting material, with which light is emitted. In the case of a carrier injection type organic electroluminescent device, in general, excitons that are excited to the excited singlet, state are 25% of the total excitons generated, and the remaining 75% thereof are excited to the excited triplet state. Accordingly, the use of phosphorescence, which is light omission from the excited triplet state, provides a high energy utilization. However, the excited triplet state has a long lifetime and thus causes saturation of the excited state and deactivation of energy through mutual action with the excitons in the excited triplet state, and therefore the quantum yield of phosphorescence may generally be often not high. A delayed fluorescent material emits fluorescent light through the mechanism that the energy of excitons transits to the excited triplet state through intersystem crossing or the like, and then transits to the excited singlet state through reverse intersystem crossing due to triplet-triplet annihilation or absorption of thermal energy, thereby emitting fluorescent light. It is considered that among the materials, a thermal activation type delayed fluorescent material emitting light through absorption of thermal energy is particularly useful for an organic electroluminescent device. In the case where a delayed fluorescent material is used in an organic electroluminescent device, the excitons in the excited singlet state normally emit fluorescent light. On the other hand, the excitons in the excited triplet state emir, fluorescent light through intersystem crossing to the excited singlet state by absorbing the heat generated by the device. At this time, the light emitted through reverse intersystem crossing from the excited triplet state to the excited singlet state has the same

wavelength as fluorescent, light since it is light emission from the excited singlet state, but has a longer lifetime (light emission lifetime) than the normal fluorescent light and phosphorescent light, and thus the light is observed as fluorescent light that is delayed from the normal fluorescent light and phosphorescent light. The light may be defined as delayed fluorescent light. The use of the thermal activation type exciton transition mechanism may raise the proportion of the compound in the excited singlet state, which is generally formed in a proportion only of 25%, to 25% or more through the absorption of the thermal energy after the carrier injection. A compound that emits strong fluorescent light and delayed fluorescent light at a low temperature of lower than 100° C. undergoes the intersystem crossing from the excited triplet state to the excited singlet state sufficiently with the heat of the device, thereby emitting delayed fluorescent light, and thus the use of the compound may drastically enhance the light emission efficiency,

[0085] The use of the compound represented by the general formula (1) of the invention as a host material or a light-emitting material of a light-emitting layer may provide an excellent organic light-emitting device, such as an organic photoluminescent device (organic EL device) and an organic electroluminescent device (organic EL device). At this time, the compound represented by the general formula (1) of the invention may have a function of assisting light emission of another light-emitting material contained in the light-emitting layer, i.e., as a so-called assist dopant. Specifically, the compound represented by the general formula (1) of the invention contained in the light-emitting layer may have a lowest excited singlet energy level that is between the lowest excited singlet energy level of the host material contained in the light-emitting layer and the lowest excited singlet energy level of the another light-emitting material contained in the light-emitting layer.

[0086] The organic photoluminescent device has a structure containing a substrate having formed thereon at least a light-emitting layer. The organic electroluminescent device has a structure containing at least an anode, a cathode and an organic layer formed between the anode and the cathode. The organic layer contains at least a light-emitting layer, and may be formed only of a light-emitting layer, or may have one or more organic layer in addition to the light-emitting layer. Examples of the organic layer include a hole transporting layer, a hole injection layer, an electron barrier layer, a hole barrier layer, an electron injection layer, an electron transporting layer and an exciton barrier layer. The hole transporting layer may be a hole injection and transporting layer having a hole injection function, and the electron transporting layer may be an electron injection and transporting layer having an electron injection function. A specific structural example of an organic electroluminescent device is shown in FIG. **1**. In FIG. **1**, the numeral **1** denotes a substrate, **2** denotes an anode, **3** denotes a hole injection layer, **4** denotes a hole transporting layer, **5** denotes a light-emitting layer, **6** denotes an electron transporting layer, and **7** denotes a cathode.

[0087] The members and the layers of the organic electroluminescent device will be described below. The descriptions for the substrate and the light-emitting layer may also be applied to the substrate and the light-emitting layer of the organic photoluminescent device.

Substrate

[0088] The organic electroluminescent device of the invention is preferably supported by a substrate. The substrate is not particularly limited and may be those that have been commonly used in an organic electroluminescent device, and examples thereof used include those formed of glass, transparent plastics, quartz, and silicon.

Anode

[0089] The anode of the organic electroluminescent device used is preferably formed of as an electrode material a metal, an alloy or an electroconductive compound each having a large work function (4 eV or more), or a mixture thereof. Specific examples of the electrode material include a metal, such as CuI and an electroconductive transparent material, such as CuI, indium tin oxide (ITO), SnO_2 and ZnO. A material that is amorphous and is capable of forming a transparent electroconductive film, such as IDIXO (In_2O_3—ZnO), may also be used. The anode may be formed in such a manner that the electrode material is formed into a thin film by such a method as vapor deposition or sputtering, and the film is patterned into a desired pattern by a photolithography method, or in the case where the pattern may not require high accuracy (for example, approximately 100 μm or more), the pattern may be formed with a mask having a desired shape on vapor deposition or sputtering of the electrode material. In alternative, in the case where a material capable of being applied as a coating, such as an organic electroconductive compound, is used, a wet film forming method, such as a printing method and a coating method, may be used. In the case where emitted light is to be taken out through the anode, the anode preferably has a transmittance of more than 10%, and the anode preferably has a sheet resistance of several hundred Ohm per square or less. The thickness thereof may be generally selected from a range of from 10 to 1,000 nm, and preferably from 10 to 200 nm, while depending on the material used.

Cathode

[0090] The cathode is preferably formed of as an electrode material a metal having a small work function (4 eV or less) (referred to as an electron injection metal, an alloy or an electroconductive compound each having a small work function (4 eV or less), or a mixture thereof. Specific examples of the electrode material include sodium, a sodium-potassium alloy, magnesium, lithium, a magnesium-cupper mixture, a magnesium-silver mixture, a magnesium-aluminum mixture, a magnesium-indium mixture, an aluminum-aluminum oxide (Al_2O_3) mixture, indium, a lithium-aluminum mixture, and a rare earth metal. Among these, a mixture of an electron injection metal and a second metal that is a stable metal having a larger work function than the electron injection metal, for example, a magnesium-silver mixture, a magnesium-aluminum mixture, a magnesium-indium mixture, an aluminum-aluminum oxide (Al_2O_3) mixture, a lithium-aluminum mixture, and aluminum, are preferred from the standpoint of the electron injection property and the durability against oxidation and the like. The cathode may be produced by forming the electrode material into a thin film by such a method as vapor deposition or sputtering. The cathode preferably has a sheet resistance of several hundred Ohm per square or less, and the thickness thereof may be generally selected from a range of from 10

nm to 5 μm, and preferably from 50 to 200 nm. For transmitting the emitted light, any one of the anode and the cathode of the organic electroluminescent device is preferably transparent or translucent, thereby enhancing the light emission luminance.

[0091] The cathode may be formed with the electroconductive transparent materials described for the anode, thereby forming a transparent or translucent cathode, and by applying the cathode, a device having an anode and a cathode, both of which have transmittance, may be produced.

Light-Emitting Layer

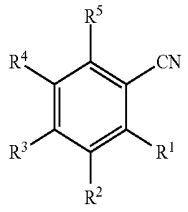
[0092] The light-emitting layer is a layer, in which holes and electrons injected from the anode and the cathode, respectively, are recombined to form excitons, and then the layer emits light. A light-emitting material may be solely used as the light-emitting layer, but the light-emitting layer preferably contains a light-emitting material and a host material.

[0093] In the case where the compound represented by the general formula (1) as a host material, one kind or two or more kinds selected from a group of compounds represented by the general formula (1) may be used. The light-emitting material may be a fluorescent light-emitting material or may be a phosphorescent light-emitting material, and in the case using a fluorescent light-emitting material, the light-emitting material is preferably one that emits delayed fluorescent light. A high light emission efficiency can be obtained thereby. In order that the organic electroluminescent device and the organic photoluminescent device of the invention exhibit a high light emission efficiency, it is important that the singlet excitons and the triplet excitons generated in the light-emitting material are confined in the light-emitting material. Accordingly, the light-emitting material combined with the compound represented by the general formula (1) is preferably a compound that has excited singlet, energy and excited triplet energy, at least one of which is higher than those of the compound represented by the general formula (1). As a result, the singlet excitons and the triplet excitons generated in the light-emitting material of the invention are capable of being confined in the molecules of the light-emitting material, thereby eliciting the light emission efficiency thereof sufficiently.

[0094] Examples of the light-emitting material combined with a host material containing the compound represented by the general formula (1) include a light-emitting material capable of emitting delayed fluorescent light. Preferred examples of the light-emitting material will be described below, but the light-emitting material capable of being used in the invention is not limited to the following examples.

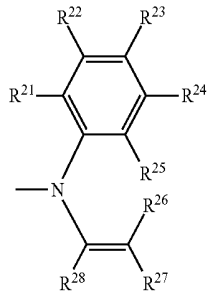
[0095] Preferred examples of the light-emitting material include compounds represented by the following general formula (101). The entire description of WO 2013/154064 including the paragraphs 0008 to 0048 and 0095 to 0133 is incorporated herein by reference.

General Formula (101)



wherein in the general formula (101), at least one of R^1 to R^5 represents a cyano group, at least one of R^1 to R^5 represents a group represented by the following general formula (111), and the balance of R^1 to R^3 each represent a hydrogen atom or a substituent.

General Formula (111)



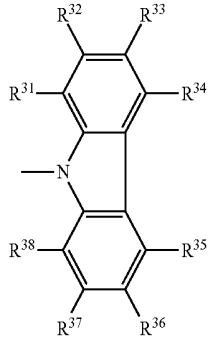
wherein in the general formula (111), R^{21} to R^{28} each independently represent a hydrogen atom or a substituent, provided that at least one of the following conditions (A) and (B) is satisfied:

[0096] (A) R^{25} and R^{26} together form a single bond, and

[0097] (B) R^{27} and R^{28} together represent an atomic group that is necessary for forming a substituted or unsubstituted benzene ring.

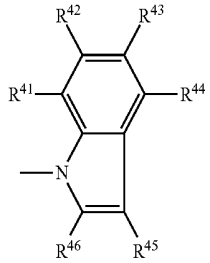
[0098] In the general formula (101), at least one of R^1 to R^5 preferably represents a group represented by any one of the following general formulae (112) to (115).

General Formula (112)



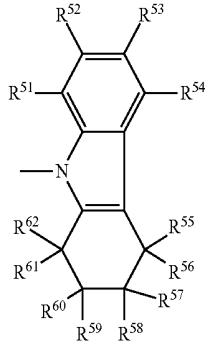
wherein in the general formula (112), R^{31} to R^{38} each independently represent a hydrogen atom or a substituent,

General Formula (113)



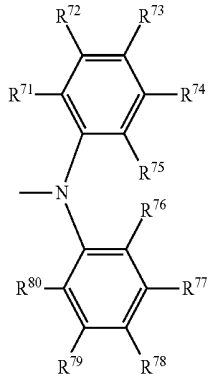
wherein in the general formula (113) R^{41} to R^{46} each independently represent a hydrogen atom or a substituent,

General Formula (114)



wherein in the general formula (114), R^{51} to R^{62} each independently represent a hydrogen atom or a substituent,

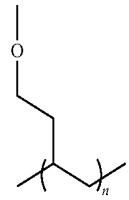
General Formula (115)



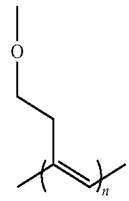
wherein in the general formula (115), R^{71} to R^{80} each independently represent a hydrogen atom or a substituent.

[0099] Specific examples of the compounds include the compounds shown in the following tables. In the case where two or more groups represented by any one of the general formulae (112) to (115) are present in the molecule of the following example compounds, ail the groups have the same structure. The formulae (121) to (124) in the tables represent the following formulae, respectively, and n represents the number of the repeating units.

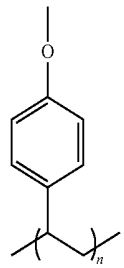
Formula (121)



Formula (122)



Formula (123)



Formula (124)

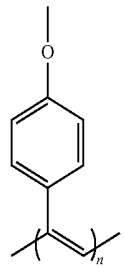


TABLE 1

Compound	General formula (1)					General formula (112)			
No.	R^1	R^2	R^3	R^4	R^5	R^{31}, R^{38}	R^{32}, R^{37}	R^{33}, R^{36}	R^{34}, R^{35}
1	General formula (112)	General formula (112)	CN	General formula (112)	General formula (112)	H	H	H	H
2	General formula (112)	General formula (112)	CN	General formula (112)	General formula (112)	H	CH_3	H	H
3	General formula (112)	General formula (112)	CN	General formula (112)	General formula (112)	H	CH_3O	H	H
4	General formula (112)	General formula (112)	CN	General formula (112)	General formula (112)	H	H	CH_3	H

TABLE 1-continued

Compound	General formula (1)					General formula (112)			
No.	R^1	R^2	R^3	R^4	R^5	R^{31}, R^{38}	R^{32}, R^{37}	R^{33}, R^{36}	R^{34}, R^{35}
5	General formula (112)	General formula (112)	CN	General formula (112)	General formula (112)	H	H	CH_3O	H
6	General formula (112)	General formula (112)	CN	General formula (112)	General formula (112)	H	H	t-C_4H_9	H
7	General formula (112)	General formula (112)	CN	General formula (112)	General formula (112)	H	H	Cl	H
8	General formula (112)	General formula (112)	CN	General formula (112)	General formula (112)	H	H	F	H
9	General formula (112)	General formula (112)	CN	General formula (112)	General formula (112)	H	H	H	CH_3
10	General formula (112)	General formula (112)	CN	General formula (112)	General formula (112)	H	H	H	CH_3O
11	General formula (112)	General formula (112)	CN	General formula (112)	H	H	H	H	H
12	General formula (112)	General formula (112)	CN	General formula (112)	H	H	CH_3	H	H
13	General formula (112)	General formula (112)	CN	General formula (112)	H	H	CH_3O	H	H
14	General formula (112)	General formula (112)	CN	General formula (112)	H	H	H	CH_3	H
15	General formula (112)	General formula (112)	CN	General formula (112)	H	H	H	CH_3O	H
16	General formula (112)	General formula (112)	CN	General formula (112)	H	H	H	t-C_4H_9	H
17	General formula (112)	General formula (112)	CN	General formula (112)	H	H	H	Cl	H
18	General formula (112)	General formula (112)	CN	General formula (112)	H	H	H	F	H
19	General formula (112)	General formula (112)	CN	General formula (112)	H	H	H	H	CH_3
20	General formula (112)	General formula (112)	CN	General formula (112)	H	H	H	H	CH_3O
21	General formula (112)	General formula (112)	CN	H	H	H	H	H	H
22	General formula (112)	General formula (112)	CN	H	H	H	CH_3	H	H
23	General formula (112)	General formula (112)	CN	H	H	H	CH_3O	H	H
24	General formula (112)	General formula (112)	CN	H	H	H	H	CH_3	H
25	General formula (112)	General formula (112)	CN	H	H	H	H	CH_3O	H
26	General formula (112)	General formula (112)	CN	H	H	H	H	t-C_4H_9	H
27	General formula (112)	General formula (112)	CN	H	H	H	H	Cl	H
28	General formula (112)	General formula (112)	CN	H	H	H	H	F	H
29	General formula (112)	General formula (112)	CN	H	H	H	H	H	CH_3
30	General formula (112)	General formula (112)	CN	H	H	H	H	H	CH_3O
31	General formula (112)	H	CN	General formula (112)	H	H	H	H	H
32	General formula (112)	H	CN	General formula (112)	H	H	CH_3	H	H
33	General formula (112)	H	CN	General formula (112)	H	H	CH_3O	H	H
34	General formula (112)	H	CN	General formula (112)	H	H	H	CH_3	H
35	General formula (112)	H	CN	General formula (112)	H	H	H	CH_3O	H
36	General formula (112)	H	CN	General formula (112)	H	H	H	t-C_4H_9	H
37	General formula (112)	H	CN	General formula (112)	H	H	H	Cl	H
38	General formula (112)	H	CN	General formula (112)	H	H	H	F	H
39	General formula (112)	H	CN	General formula (112)	H	H	H	H	CH_3
40	General formula (112)	H	CN	General formula (112)	H	H	H	H	CH_3O
41	General formula (112)	H	CN	H	General formula (112)	H	H	H	H

TABLE 1-continued

Compound	General formula (1)					General formula (112)			
No.	R^1	R^2	R^3	R^4	R^5	R^{31}, R^{38}	R^{32}, R^{37}	R^{33}, R^{36}	R^{34}, R^{35}
42	General formula (112)	H	CN	H	General formula (112)	H	CH_3	H	H
43	General formula (112)	H	CN	H	General formula (112)	H	CH_3O	H	H
44	General formula (112)	H	CN	H	General formula (112)	H	H	CH_3	H
45	General formula (112)	H	CN	H	General formula (112)	H	H	CH_3O	H
46	General formula (112)	H	CN	H	General formula (112)	H	H	t-C_4H_9	H
47	General formula (112)	H	CN	H	General formula (112)	H	H	Cl	H
48	General formula (112)	H	CN	H	General formula (112)	H	H	F	H
49	General formula (112)	H	CN	H	General formula (112)	H	H	H	CH_3
50	General formula (112)	H	CN	H	General formula (112)	H	H	H	CH_3O
51	General formula (112)	H	CN	H	H	H	H	H	H
52	General formula (112)	H	CN	H	H	H	CH_3	H	H
53	General formula (112)	H	CN	H	H	H	CH_3O	H	H
54	General formula (112)	H	CN	H	H	H	H	CH_3	H
55	General formula (112)	H	CN	H	H	H	H	CH_3O	H
56	General formula (112)	H	CN	H	H	H	H	t-C_4H_9	H
57	General formula (112)	H	CN	H	H	H	H	Cl	H
58	General formula (112)	H	CN	H	H	H	H	F	H
59	General formula (112)	H	CN	H	H	H	H	H	CH_3
60	General formula (112)	H	CN	H	H	H	H	H	CH_3O
61	General formula (112)	General formula (112)	CN	General formula (112)	F	H	H	H	H
62	General formula (112)	General formula (112)	CN	General formula (112)	F	H	CH_3	H	H
63	General formula (112)	General formula (112)	CN	General formula (112)	F	H	CH_3O	H	H
64	General formula (112)	General formula (112)	CN	General formula (112)	F	H	H	CH_3	H
65	General formula (112)	General formula (112)	CN	General formula (112)	F	H	H	CH_3O	H
66	General formula (112)	General formula (112)	CN	General formula (112)	F	H	H	t-C_4H_9	H
67	General formula (112)	General formula (112)	CN	General formula (112)	F	H	H	Cl	H
68	General formula (112)	General formula (112)	CN	General formula (112)	F	H	H	F	H
69	General formula (112)	General formula (112)	CN	General formula (112)	F	H	H	H	CH_3
70	General formula (112)	General formula (112)	CN	General formula (112)	F	H	H	H	CH_3O
71	General formula (112)	General formula (112)	CN	F	F	H	H	H	H
72	General formula (112)	General formula (112)	CN	F	F	H	CH_3	H	H
73	General formula (112)	General formula (112)	CN	F	F	H	CH_3O	H	H
74	General formula (112)	General formula (112)	CN	F	F	H	H	CH_3	H
75	General formula (112)	General formula (112)	CN	F	F	H	H	CH_3O	H
76	General formula (112)	General formula (112)	CN	F	F	H	H	t-C_4H_9	H
77	General formula (112)	General formula (112)	CN	F	F	H	H	Cl	H

TABLE 1-continued

Compound	General formula (1)					General formula (112)			
No.	R^1	R^2	R^3	R^4	R^5	R^{31}, R^{38}	R^{32}, R^{37}	R^{33}, R^{36}	R^{34}, R^{35}
78	General formula (112)	General formula (112)	CN	F	F	H	H	F	H
79	General formula (112)	General formula (112)	CN	F	F	H	H	H	CH_3
80	General formula (112)	General formula (112)	CN	F	F	H	H	H	CH_3O
81	General formula (112)	F	CN	General formula (112)	F	H	H	H	H
82	General formula (112)	F	CN	General formula (112)	F	H	CH_3	H	H
83	General formula (112)	F	CN	General formula (112)	F	H	CH_3O	H	H
84	General formula (112)	F	CN	General formula (112)	F	H	H	CH_3	H
85	General formula (112)	F	CN	General formula (112)	F	H	H	CH_3O	H
86	General formula (112)	F	CN	General formula (112)	F	H	H	t-C_4H_9	H
87	General formula (112)	F	CN	General formula (112)	F	H	H	Cl	H
88	General formula (112)	F	CN	General formula (112)	F	H	H	F	H
89	General formula (112)	F	CN	General formula (112)	F	H	H	H	CH_3
90	General formula (112)	F	CN	General formula (112)	F	H	H	H	CH_3O
91	General formula (112)	F	CN	F	General formula (112)	H	H	H	H
92	General formula (112)	F	CN	F	General formula (112)	H	CH_3	H	H
93	General formula (112)	F	CN	F	General formula (112)	H	CH_3O	H	H
94	General formula (112)	F	CN	F	General formula (112)	H	H	CH_3	H
95	General formula (112)	F	CN	F	General formula (112)	H	H	CH_3O	H
96	General formula (112)	F	CN	F	General formula (112)	H	H	t-C_4H_9	H
97	General formula (112)	F	CN	F	General formula (112)	H	H	Cl	H
98	General formula (112)	F	CN	F	General formula (112)	H	H	F	H
99	General formula (112)	F	CN	F	General formula (112)	H	H	H	CH_3
100	General formula (112)	F	CN	F	General formula (112)	H	H	H	CH_3O
101	General formula (112)	F	CN	F	F	H	H	H	H
102	General formula (112)	F	CN	F	F	H	CH_3	H	H
103	General formula (112)	F	CN	F	F	H	CH_3O	H	H
104	General formula (112)	F	CN	F	F	H	H	CH_3	H
105	General formula (112)	F	CN	F	F	H	H	CH_3O	H
106	General formula (112)	F	CN	F	F	H	H	t-C_4H_9	H
107	General formula (112)	F	CN	F	F	H	H	Cl	H
108	General formula (112)	F	CN	F	F	H	H	F	H
109	General formula (112)	F	CN	F	F	H	H	H	CH_3
110	General formula (112)	F	CN	F	F	H	H	H	CH_3O
111	General formula (112)	General formula (112)	CN	General formula (112)	OH	H	H	H	H
112	General formula (112)	General formula (112)	CN	General formula (112)	OH	H	CH_3	H	H
113	General formula (112)	General formula (112)	CN	General formula (112)	OH	H	CH_3O	H	H
114	General formula (112)	General formula (112)	CN	General formula (112)	OH	H	H	CH_3	H

TABLE 1-continued

Compound	General formula (1)					General formula (112)			
No.	R^1	R^2	R^3	R^4	R^5	R^{31}, R^{38}	R^{32}, R^{37}	R^{33}, R^{36}	R^{34}, R^{35}
115	General formula (112)	General formula (112)	CN	General formula (112)	OH	H	H	CH_3O	H
116	General formula (112)	General formula (112)	CN	General formula (112)	OH	H	H	t-C_4H_9	H
117	General formula (112)	General formula (112)	CN	General formula (112)	OH	H	H	Cl	H
118	General formula (112)	General formula (112)	CN	General formula (112)	OH	H	H	F	H
119	General formula (112)	General formula (112)	CN	General formula (112)	OH	H	H	H	CH_3
120	General formula (112)	General formula (112)	CN	General formula (112)	OH	H	H	H	CH_3O
121	General formula (112)	General formula (112)	CN	OH	OH	H	H	H	H
122	General formula (112)	General formula (112)	CN	OH	OH	H	CH_3	H	H
123	General formula (112)	General formula (112)	CN	OH	OH	H	CH_3O	H	H
124	General formula (112)	General formula (112)	CN	OH	OH	H	H	CH_3	H
125	General formula (112)	General formula (112)	CN	OH	OH	H	H	CH_3O	H
126	General formula (112)	General formula (112)	CN	OH	OH	H	H	t-C_4H_9	H
127	General formula (112)	General formula (112)	CN	OH	OH	H	H	Cl	H
128	General formula (112)	General formula (112)	CN	OH	OH	H	H	F	H
129	General formula (112)	General formula (112)	CN	OH	OH	H	H	H	CH_3
130	General formula (112)	General formula (112)	CN	OH	OH	H	H	H	CH_3O
131	General formula (112)	OH	CN	General formula (112)	OH	H	H	H	H
132	General formula (112)	OH	CN	General formula (112)	OH	H	CH_3	H	H
133	General formula (112)	OH	CN	General formula (112)	OH	H	CH_3O	H	H
134	General formula (112)	OH	CN	General formula (112)	OH	H	H	CH_3	H
135	General formula (112)	OH	CN	General formula (112)	OH	H	H	CH_3O	H
136	General formula (112)	OH	CN	General formula (112)	OH	H	H	t-C_4H_9	H
137	General formula (112)	OH	CN	General formula (112)	OH	H	H	Cl	H
138	General formula (112)	OH	CN	General formula (112)	OH	H	H	F	H
139	General formula (112)	OH	CN	General formula (112)	OH	H	H	H	CH_3
140	General formula (112)	OH	CN	General formula (112)	OH	H	H	H	CH_3O
141	General formula (112)	OH	CN	OH	General formula (112)	H	H	H	H
142	General formula (112)	OH	CN	OH	General formula (112)	H	CH_3	H	H
143	General formula (112)	OH	CN	OH	General formula (112)	H	CH_3O	H	H
144	General formula (112)	OH	CN	OH	General formula (112)	H	H	CH_3	H
145	General formula (112)	OH	CN	OH	General formula (112)	H	H	CH_3O	H
146	General formula (112)	OH	CN	OH	General formula (112)	H	H	t-C_4H_9	H
147	General formula (112)	OH	CN	OH	General formula (112)	H	H	Cl	H
148	General formula (112)	OH	CN	OH	General formula (112)	H	H	F	H
149	General formula (112)	OH	CN	OH	General formula (112)	H	H	H	CH_3
150	General formula (112)	OH	CN	OH	General formula (112)	H	H	H	CH_3O

TABLE 1-continued

Compound	General formula (1)					General formula (112)			
No.	R^1	R^2	R^3	R^4	R^5	R^{31}, R^{38}	R^{32}, R^{37}	R^{33}, R^{36}	R^{34}, R^{35}
151	General formula (112)	OH	CN	OH	OH	H	H	H	H
152	General formula (112)	OH	CN	OH	OH	H	CH_3	H	H
153	General formula (112)	OH	CN	OH	OH	H	CH_3O	H	H
154	General formula (112)	OH	CN	OH	OH	H	H	CH_3	H
155	General formula (112)	OH	CN	OH	OH	H	H	CH_3O	H
156	General formula (112)	OH	CN	OH	OH	H	H	t-C_4H_9	H
157	General formula (112)	OH	CN	OH	OH	H	H	Cl	H
158	General formula (112)	OH	CN	OH	OH	H	H	F	H
159	General formula (112)	OH	CN	OH	OH	H	H	H	CH_3
160	General formula (112)	OH	CN	OH	OH	H	H	H	CH_3O
161	General formula (112)	General formula (112)	CN	General formula (112)	Cl	H	H	H	H
162	General formula (112)	General formula (112)	CN	General formula (112)	Cl	H	CH_3	H	H
163	General formula (112)	General formula (112)	CN	General formula (112)	Cl	H	CH_3O	H	H
164	General formula (112)	General formula (112)	CN	General formula (112)	Cl	H	H	CH_3	H
165	General formula (112)	General formula (112)	CN	General formula (112)	Cl	H	H	CH_3O	H
166	General formula (112)	General formula (112)	CN	General formula (112)	Cl	H	H	t-C_4H_9	H
167	General formula (112)	General formula (112)	CN	General formula (112)	Cl	H	H	Cl	H
168	General formula (112)	General formula (112)	CN	General formula (112)	Cl	H	H	F	H
169	General formula (112)	General formula (112)	CN	General formula (112)	Cl	H	H	H	CH_3
170	General formula (112)	General formula (112)	CN	General formula (112)	Cl	H	H	H	CH_3O
171	General formula (112)	General formula (112)	CN	General formula (112)	F	H	H	H	H
172	General formula (112)	General formula (112)	CN	General formula (112)	F	H	CH_3	H	H
173	General formula (112)	General formula (112)	CN	General formula (112)	F	H	CH_3O	H	H
174	General formula (112)	General formula (112)	CN	General formula (112)	F	H	H	CH_3	H
175	General formula (112)	General formula (112)	CN	General formula (112)	F	H	H	CH_3O	H
176	General formula (112)	General formula (112)	CN	General formula (112)	F	H	H	t-C_4H_9	H
177	General formula (112)	General formula (112)	CN	General formula (112)	F	H	H	Cl	H
178	General formula (112)	General formula (112)	CN	General formula (112)	F	H	H	F	H
179	General formula (112)	General formula (112)	CN	General formula (112)	F	H	H	H	CH_3
180	General formula (112)	General formula (112)	CN	General formula (112)	F	H	H	H	CH_3O
181	General formula (112)	General formula (112)	CN	General formula (112)	CH_3O	H	H	H	H
182	General formula (112)	General formula (112)	CN	General formula (112)	CH_3O	H	CH_3	H	H
183	General formula (112)	General formula (112)	CN	General formula (112)	CH_3O	H	CH_3O	H	H
184	General formula (112)	General formula (112)	CN	General formula (112)	CH_3O	H	H	CH_3	H
185	General formula (112)	General formula (112)	CN	General formula (112)	CH_3O	H	H	CH_3O	H
186	General formula (112)	General formula (112)	CN	General formula (112)	CH_3O	H	H	t-C_4H_9	H
187	General formula (112)	General formula (112)	CN	General formula (112)	CH_3O	H	H	Cl	H

TABLE 1-continued

Compound	General formula (1)					General formula (112)			
No.	R^1	R^2	R^3	R^4	R^5	R^{31}, R^{38}	R^{32}, R^{37}	R^{33}, R^{36}	R^{34}, R^{35}
188	General formula (112)	General formula (112)	CN	General formula (112)	CH_3O	H	H	F	H
189	General formula (112)	General formula (112)	CN	General formula (112)	C_2H_5O	H	H	H	CH_3
190	General formula (112)	General formula (112)	CN	General formula (112)	C_2H_5O	H	H	H	CH_3O
191	General formula (112)	General formula (112)	CN	General formula (112)	C_2H_5O	H	H	H	H
192	General formula (112)	General formula (112)	CN	General formula (112)	C_2H_5O	H	CH_3	H	H
193	General formula (112)	General formula (112)	CN	General formula (112)	C_2H_5O	H	CH_3O	H	H
194	General formula (112)	General formula (112)	CN	General formula (112)	C_2H_5O	H	H	CH_3	H
195	General formula (112)	General formula (112)	CN	General formula (112)	C_2H_5O	H	H	CH_3O	H
196	General formula (112)	General formula (112)	CN	General formula (112)	C_2H_5O	H	H	t-C_4H_9	H
197	General formula (112)	General formula (112)	CN	General formula (112)	C_2H_5O	H	H	Cl	H
198	General formula (112)	General formula (112)	CN	General formula (112)	C_2H_5O	H	H	F	H
199	General formula (112)	General formula (112)	CN	General formula (112)	C_2H_5O	H	H	H	CH_3
200	General formula (112)	General formula (112)	CN	General formula (112)	C_2H_5O	H	H	H	CH_3O
201	General formula (112)	General formula (112)	CN	General formula (112)	C_6H_5O	H	H	H	H
202	General formula (112)	General formula (112)	CN	General formula (112)	C_6H_5O	H	CH_3	H	H
203	General formula (112)	General formula (112)	CN	General formula (112)	C_6H_5O	H	CH_3O	H	H
204	General formula (112)	General formula (112)	CN	General formula (112)	C_6H_5O	H	H	CH_3	H
205	General formula (112)	General formula (112)	CN	General formula (112)	C_6H_5O	H	H	CH_3O	H
206	General formula (112)	General formula (112)	CN	General formula (112)	C_6H_5O	H	H	t-C_4H_9	H
207	General formula (112)	General formula (112)	CN	General formula (112)	C_6H_5O	H	H	Cl	H
208	General formula (112)	General formula (112)	CN	General formula (112)	C_6H_5O	H	H	F	H
209	General formula (112)	General formula (112)	CN	General formula (112)	C_6H_5O	H	H	H	CH_3
210	General formula (112)	General formula (112)	CN	General formula (112)	C_6H_5O	H	H	H	CH_3O
211	General formula (112)	General formula (112)	CN	General formula (112)	Formula (121)	H	H	H	H
212	General formula (112)	General formula (112)	CN	General formula (112)	Formula (121)	H	CH_3	H	H
213	General formula (112)	General formula (112)	CN	General formula (112)	Formula (121)	H	CH_3O	H	H
214	General formula (112)	General formula (112)	CN	General formula (112)	Formula (121)	H	H	CH_3	H
215	General formula (112)	General formula (112)	CN	General formula (112)	Formula (121)	H	H	CH_3O	H
216	General formula (112)	General formula (112)	CN	General formula (112)	Formula (121)	H	H	t-C_4H_9	H
217	General formula (112)	General formula (112)	CN	General formula (112)	Formula (121)	H	H	Cl	H
218	General formula (112)	General formula (112)	CN	General formula (112)	Formula (121)	H	H	F	H
219	General formula (112)	General formula (112)	CN	General formula (112)	Formula (121)	H	H	H	CH_3
220	General formula (112)	General formula (112)	CN	General formula (112)	Formula (121)	H	H	H	CH_3O
221	General formula (112)	General formula (112)	CN	General formula (112)	Formula (122)	H	H	H	H
222	General formula (112)	General formula (112)	CN	General formula (112)	Formula (122)	H	CH_3	H	H
223	General formula (112)	General formula (112)	CN	General formula (112)	Formula (122)	H	CH_3O	H	H

TABLE 1-continued

Compound	General formula (1)					General formula (112)			
No.	R^1	R^2	R^3	R^4	R^5	R^{31}, R^{38}	R^{32}, R^{37}	R^{33}, R^{36}	R^{34}, R^{35}
224	General formula (112)	General formula (112)	CN	General formula (112)	Formula (122)	H	H	CH_3	H
225	General formula (112)	General formula (112)	CN	General formula (112)	Formula (122)	H	H	CH_3O	H
226	General formula (112)	General formula (112)	CN	General formula (112)	Formula (122)	H	H	t-C_4H_9	H
227	General formula (112)	General formula (112)	CN	General formula (112)	Formula (122)	H	H	Cl	H
228	General formula (112)	General formula (112)	CN	General formula (112)	Formula (122)	H	H	F	H
229	General formula (112)	General formula (112)	CN	General formula (112)	Formula (122)	H	H	H	CH_3
230	General formula (112)	General formula (112)	CN	General formula (112)	Formula (122)	H	H	H	CH_3O
231	General formula (112)	General formula (112)	CN	General formula (112)	Formula (123)	H	H	H	H
232	General formula (112)	General formula (112)	CN	General formula (112)	Formula (123)	H	CH_3	H	H
233	General formula (112)	General formula (112)	CN	General formula (112)	Formula (123)	H	CH_3O	H	H
234	General formula (112)	General formula (112)	CN	General formula (112)	Formula (123)	H	H	CH_3	H
235	General formula (112)	General formula (112)	CN	General formula (112)	Formula (123)	H	H	CH_3O	H
236	General formula (112)	General formula (112)	CN	General formula (112)	Formula (123)	H	H	t-C_4H_9	H
237	General formula (112)	General formula (112)	CN	General formula (112)	Formula (123)	H	H	Cl	H
238	General formula (112)	General formula (112)	CN	General formula (112)	Formula (123)	H	H	F	H
239	General formula (112)	General formula (112)	CN	General formula (112)	Formula (123)	H	H	H	CH_3
240	General formula (112)	General formula (112)	CN	General formula (112)	Formula (123)	H	H	H	CH_3O
241	General formula (112)	General formula (112)	CN	General formula (112)	Formula (124)	H	H	H	H
242	General formula (112)	General formula (112)	CN	General formula (112)	Formula (124)	H	CH_3	H	H
243	General formula (112)	General formula (112)	CN	General formula (112)	Formula (124)	H	CH_3O	H	H
244	General formula (112)	General formula (112)	CN	General formula (112)	Formula (124)	H	H	CH_3	H
245	General formula (112)	General formula (112)	CN	General formula (112)	Formula (124)	H	H	CH_3O	H
246	General formula (112)	General formula (112)	CN	General formula (112)	Formula (124)	H	H	t-C_4H_9	H
247	General formula (112)	General formula (112)	CN	General formula (112)	Formula (124)	H	H	Cl	H
248	General formula (112)	General formula (112)	CN	General formula (112)	Formula (124)	H	H	F	H
249	General formula (112)	General formula (112)	CN	General formula (112)	Formula (124)	H	H	H	CH_3
250	General formula (112)	General formula (112)	CN	General formula (112)	Formula (124)	H	H	H	CH_3O
251	General formula (112)	General formula (112)	CN	General formula (112)	General formula (112)	H	C_6H_5	H	H
252	General formula (112)	General formula (112)	CN	General formula (112)	General formula (112)	H	H	C_5H_6	H
253	General formula (112)	General formula (112)	CN	General formula (112)	H	H	C_6H_5	H	H
254	General formula (112)	General formula (112)	CN	General formula (112)	H	H	H	C_5H_6	H
255	General formula (112)	General formula (112)	CN	H	H	H	C_6H_5	H	H
256	General formula (112)	General formula (112)	CN	H	H	H	H	C_6H_5	H
257	General formula (112)	H	CN	General formula (112)	H	H	C_6H_5	H	H
258	General formula (112)	H	CN	General formula (112)	H	H	H	C_6H_5	H
259	General formula (112)	H	CN	H	General formula (112)	H	C_6H_5	H	H
260	General formula (112)	H	CN	H	General formula (112)	H	H	C_6H_5	H

TABLE 1-continued

Compound	General formula (1)					General formula (112)			
No.	R^1	R^2	R^3	R^4	R^5	R^{31}, R^{38}	R^{32}, R^{37}	R^{33}, R^{36}	R^{34}, R^{35}
261	General formula (112)	H	CN	H	H	H	C_6H_5	H	H
262	General formula (112)	H	CN	H	H	H	H	C_6H_5	H
263	General formula (112)	General formula (112)	CN	General formula (112)	F	H	C_6H_5	H	H
264	General formula (112)	General formula (112)	CN	General formula (112)	F	H	H	C_6H_5	H
265	General formula (112)	General formula (112)	CN	F	F	H	C_6H_5	H	H
266	General formula (112)	General formula (112)	CN	F	F	H	H	C_6H_5	H
267	General formula (112)	F	CN	General formula (112)	F	H	C_6H_5	H	H
268	General formula (112)	F	CN	General formula (112)	F	H	H	C_6H_5	H
269	General formula (112)	F	CN	F	General formula (112)	H	C_6H_5	H	H
270	General formula (112)	F	CN	F	General formula (112)	H	H	C_6H_5	H
271	General formula (112)	F	CN	F	F	H	C_6H_5	H	H
272	General formula (112)	F	CN	F	F	H	H	C_6H_5	H
273	General formula (112)	General formula (112)	CN	General formula (112)	OH	H	C_6H_5	H	H
274	General formula (112)	General formula (112)	CN	General formula (112)	OH	H	H	C_6H_5	H
275	General formula (112)	General formula (112)	CN	OH	OH	H	C_6H_5	H	H
276	General formula (112)	General formula (112)	CN	OH	OH	H	H	C_6H_5	H
277	General formula (112)	OH	CN	General formula (112)	OH	H	C_6H_5	H	H
278	General formula (112)	OH	CN	General formula (112)	OH	H	H	C_6H_5	H
279	General formula (112)	OH	CN	OH	General formula (112)	H	C_6H_5	H	H
280	General formula (112)	OH	CN	OH	General formula (112)	H	H	C_6H_5	H
281	General formula (112)	OH	CN	OH	OH	H	C_6H_5	H	H
282	General formula (112)	OH	CN	OH	OH	H	H	C_6H_5	H
283	General formula (112)	General formula (112)	CN	General formula (112)	Cl	H	C_6H_5	H	H
284	General formula (112)	General formula (112)	CN	General formula (112)	Cl	H	H	C_6H_5	H
285	General formula (112)	General formula (112)	CN	General formula (112)	F	H	C_6H_5	H	H
286	General formula (112)	General formula (112)	CN	General formula (112)	F	H	H	C_6H_5	H
287	General formula (112)	General formula (112)	CN	General formula (112)	CH_3O	H	C_6H_5	H	H
288	General formula (112)	General formula (112)	CN	General formula (112)	CH_3O	H	H	C_6H_5	H
289	General formula (112)	General formula (112)	CN	General formula (112)	C_2H_5O	H	C_6H_5	H	H
290	General formula (112)	General formula (112)	CN	General formula (112)	C_2H_5O	H	H	C_6H_5	H
291	General formula (112)	General formula (112)	CN	General formula (112)	C_6H_5O	H	C_6H_5	H	H
292	General formula (112)	General formula (112)	CN	General formula (112)	C_6H_5O	H	H	C_6H_5	H
293	General formula (112)	General formula (112)	CN	General formula (112)	Formula (121)	H	C_6H_5	H	H
294	General formula (112)	General formula (112)	CN	General formula (112)	Formula (121)	H	H	C_6H_5	H
295	General formula (112)	General formula (112)	CN	General formula (112)	Formula (122)	H	C_6H_5	H	H
296	General formula (112)	General formula (112)	CN	General formula (112)	Formula (122)	H	H	C_6H_5	H

TABLE 1-continued

Compound	General formula (1)					General formula (112)			
No.	R^1	R^2	R^3	R^4	R^5	R^{31}, R^{38}	R^{32}, R^{37}	R^{33}, R^{36}	R^{34}, R^{35}
297	General formula (112)	General formula (112)	CN	General formula (112)	Formula (123)	H	C_6H_5	H	H
298	General formula (112)	General formula (112)	CN	General formula (112)	Formula (123)	H	H	C_6H_5	H
299	General formula (112)	General formula (112)	CN	General formula (112)	Formula (124)	H	C_6H_5	H	H
300	General formula (112)	General formula (112)	CN	General formula (112)	Formula (124)	H	H	C_6H_5	H

TABLE 2

Compound	General formula (1)					General formula (112)			
No.	R^1	R^2	R^3	R^4	R^5	R^{31}, R^{38}	R^{32}, R^{37}	R^{33}, R^{36}	R^{34}, R^{35}
301	General formula (112)	CN	General formula (112)	General formula (112)	General formula (112)	H	H	H	H
302	General formula (112)	CN	General formula (112)	General formula (112)	General formula (112)	H	CH_3	H	H
303	General formula (112)	CN	General formula (112)	General formula (112)	General formula (112)	H	CH_3O	H	H
304	General formula (112)	CN	General formula (112)	General formula (112)	General formula (112)	H	H	CH_3	H
305	General formula (112)	CN	General formula (112)	General formula (112)	General formula (112)	H	H	CH_3O	H
306	General formula (112)	CN	General formula (112)	General formula (112)	General formula (112)	H	H	t-C_4H_9	H
307	General formula (112)	CN	General formula (112)	General formula (112)	General formula (112)	H	H	Cl	H
308	General formula (112)	CN	General formula (112)	General formula (112)	General formula (112)	H	H	F	H
309	General formula (112)	CN	General formula (112)	General formula (112)	General formula (112)	H	H	H	CH_3
310	General formula (112)	CN	General formula (112)	General formula (112)	General formula (112)	H	H	H	CH_3O
311	General formula (112)	CN	General formula (112)	General formula (112)	H	H	H	H	H
312	General formula (112)	CN	General formula (112)	General formula (112)	H	H	H	CH_3	H
313	General formula (112)	CN	General formula (112)	General formula (112)	H	H	H	CH_3O	H
314	General formula (112)	CN	General formula (112)	H	General formula (112)	H	H	H	H
315	General formula (112)	CN	General formula (112)	H	General formula (112)	H	H	CH_3	H
316	General formula (112)	CN	General formula (112)	H	General formula (112)	H	H	CH_3O	H
317	General formula (112)	CN	H	General formula (112)	General formula (112)	H	H	H	H
318	General formula (112)	CN	H	General formula (112)	General formula (112)	H	H	CH_3	H
319	General formula (112)	CN	H	General formula (112)	General formula (112)	H	H	CH_3O	H
320	H	CN	General formula (112)	General formula (112)	General formula (112)	H	H	H	H
321	H	CN	General formula (112)	General formula (112)	General formula (112)	H	H	CH_3	H
322	H	CN	General formula (112)	General formula (112)	General formula (112)	H	H	CH_3O	H
323	General formula (112)	CN	General formula (112)	H	H	H	H	H	H
324	General formula (112)	CN	General formula (112)	H	H	H	H	CH_3	H
325	General formula (112)	CN	General formula (112)	H	H	H	H	CH_3O	H
326	General formula (112)	CN	H	General formula (112)	H	H	H	H	H
327	General formula (112)	CN	H	General formula (112)	H	H	H	CH_3	H
328	General formula (112)	CN	H	General formula (112)	H	H	H	CH_3O	H

TABLE 2-continued

Compound	General formula (1)					General formula (112)			
No.	R^1	R^2	R^3	R^4	R^5	R^{31}, R^{38}	R^{32}, R^{37}	R^{33}, R^{36}	R^{34}, R^{35}
329	H	CN	General formula (112)	General formula (112)	H	H	H	H	H
330	H	CN	General formula (112)	General formula (112)	H	H	H	CH_3	H
331	H	CN	General formula (112)	General formula (112)	H	H	H	CH_3O	H
332	General formula (112)	CN	H	H	General formula (112)	H	H	H	H
333	General formula (112)	CN	H	H	General formula (112)	H	H	CH_3	H
334	General formula (112)	CN	H	H	General formula (112)	H	H	CH_3O	H
335	H	CN	General formula (112)	H	General formula (112)	H	H	H	H
336	H	CN	General formula (112)	H	General formula (112)	H	H	CH_3	H
337	H	CN	General formula (112)	H	General formula (112)	H	H	CH_3O	H
338	H	CN	H	General formula (112)	General formula (112)	H	H	H	H
339	H	CN	H	General formula (112)	General formula (112)	H	H	CH_3	H
340	H	CN	H	General formula (112)	General formula (112)	H	H	CH_3O	H
341	General formula (112)	CN	H	H	H	H	H	H	H
342	General formula (112)	CN	H	H	H	H	H	CH_3	H
343	General formula (112)	CN	H	H	H	H	H	CH_3O	H
344	H	CN	General formula (112)	H	H	H	H	H	H
345	H	CN	General formula (112)	H	H	H	H	CH_3	H
346	H	CN	General formula (112)	H	H	H	H	CH_3O	H
347	H	CN	H	General formula (112)	H	H	H	H	H
348	H	CN	H	General formula (112)	H	H	H	CH_3	H
349	H	CN	H	General formula (112)	H	H	H	CH_3O	H
350	General formula (112)	CN	General formula (112)	General formula (112)	F	H	H	H	H
351	General formula (112)	CN	General formula (112)	General formula (112)	F	H	H	CH_3	H
352	General formula (112)	CN	General formula (112)	General formula (112)	F	H	H	CH_3O	H
353	General formula (112)	CN	General formula (112)	F	General formula (112)	H	H	H	H
354	General formula (112)	CN	General formula (112)	F	General formula (112)	H	H	CH_3	H
355	General formula (112)	CN	General formula (112)	F	General formula (112)	H	H	CH_3O	H
356	General formula (112)	CN	F	General formula (112)	General formula (112)	H	H	H	H
357	General formula (112)	CN	F	General formula (112)	General formula (112)	H	H	CH_3	H
358	General formula (112)	CN	F	General formula (112)	General formula (112)	H	H	CH_3O	H
359	F	CN	General formula (112)	General formula (112)	General formula (112)	H	H	H	H
360	F	CN	General formula (112)	General formula (112)	General formula (112)	H	H	CH_3	H
361	F	CN	General formula (112)	General formula (112)	General formula (112)	H	H	CH_3O	H
362	General formula (112)	CN	General formula (112)	F	F	H	H	H	H
363	General formula (112)	CN	General formula (112)	F	F	H	H	CH_3	H
364	General formula (112)	CN	General formula (112)	F	F	H	H	CH_3O	H

TABLE 2-continued

Compound	General formula (1)					General formula (112)			
No.	R^1	R^2	R^3	R^4	R^5	R^{31}, R^{38}	R^{32}, R^{37}	R^{33}, R^{36}	R^{34}, R^{35}
365	General formula (112)	CN	F	General formula (112)	F	H	H	H	H
366	General formula (112)	CN	F	General formula (112)	F	H	H	CH_3	H
367	General formula (112)	CN	F	General formula (112)	F	H	H	CH_3O	H
368	F	CN	General formula (112)	General formula (112)	F	H	H	H	H
369	F	CN	General formula (112)	General formula (112)	F	H	H	CH_3	H
370	F	CN	General formula (112)	General formula (112)	F	H	H	CH_3O	H
371	General formula (112)	CN	F	F	General formula (112)	H	H	H	H
372	General formula (112)	CN	F	F	General formula (112)	H	H	CH_3	H
373	General formula (112)	CN	F	F	General formula (112)	H	H	CH_3O	H
374	F	CN	General formula (112)	F	General formula (112)	H	H	H	H
375	F	CN	General formula (112)	F	General formula (112)	H	H	CH_3	H
376	F	CN	General formula (112)	F	General formula (112)	H	H	CH_3O	H
377	F	CN	F	General formula (112)	General formula (112)	H	H	H	H
378	F	CN	F	General formula (112)	General formula (112)	H	H	CH_3	H
379	F	CN	F	General formula (112)	General formula (112)	H	H	CH_3O	H
380	General formula (112)	CN	F	F	F	H	H	H	H
381	General formula (112)	CN	F	F	F	H	H	CH_3	H
382	General formula (112)	CN	F	F	F	H	H	CH_3O	H
383	F	CN	General formula (112)	F	F	H	H	H	H
384	F	CN	General formula (112)	F	F	H	H	CH_3	H
385	F	CN	General formula (112)	F	F	H	H	CH_3O	H
386	F	CN	F	General formula (112)	F	H	H	H	H
387	F	CN	F	General formula (112)	F	H	H	CH_3	H
388	F	CN	F	General formula (112)	F	H	H	CH_3O	H
389	General formula (112)	CN	General formula (112)	General formula (112)	OH	H	H	H	H
390	General formula (112)	CN	General formula (112)	General formula (112)	OH	H	H	CH_3	H
391	General formula (112)	CN	General formula (112)	General formula (112)	OH	H	H	CH_3O	H
392	General formula (112)	CN	General formula (112)	OH	General formula (112)	H	H	H	H
393	General formula (112)	CN	General formula (112)	OH	General formula (112)	H	H	CH_3	H
394	General formula (112)	CN	General formula (112)	OH	General formula (112)	H	H	CH_3O	H
395	General formula (112)	CN	General formula (112)	OH	General formula (112)	H	H	t-C_4H_9	H
396	General formula (112)	CN	General formula (112)	OH	General formula (112)	H	H	Cl	H
397	General formula (112)	CN	General formula (112)	OH	General formula (112)	H	H	F	H
398	General formula (112)	CN	OH	General formula (112)	General formula (112)	H	H	H	H
399	General formula (112)	CN	OH	General formula (112)	General formula (112)	H	H	CH_3	H
400	General formula (112)	CN	OH	General formula (112)	General formula (112)	H	H	CH_3O	H
401	OH	CN	General formula (112)	General formula (112)	General formula (112)	H	H	H	H

TABLE 2-continued

Compound	General formula (1)					General formula (112)			
No.	R^1	R^2	R^3	R^4	R^5	R^{31}, R^{38}	R^{32}, R^{37}	R^{33}, R^{36}	R^{34}, R^{35}
402	OH	CN	General formula (112)	General formula (112)	General formula (112)	H	H	CH_3	H
403	OH	CN	General formula (112)	General formula (112)	General formula (112)	H	H	CH_3O	H
404	General formula (112)	CN	General formula (112)	OH	OH	H	H	H	H
405	General formula (112)	CN	General formula (112)	OH	OH	H	H	CH_3	H
406	General formula (112)	CN	General formula (112)	OH	OH	H	H	CH_3O	H
407	General formula (112)	CN	OH	General formula (112)	OH	H	H	H	H
408	General formula (112)	CN	OH	General formula (112)	OH	H	H	CH_3	H
409	General formula (112)	CN	OH	General formula (112)	OH	H	H	CH_3O	H
410	OH	CN	General formula (112)	General formula (112)	OH	H	H	H	H
411	OH	CN	General formula (112)	General formula (112)	OH	H	H	CH_3	H
412	OH	CN	General formula (112)	General formula (112)	OH	H	H	CH_3O	H
413	General formula (112)	CN	OH	OH	General formula (112)	H	H	H	H
414	General formula (112)	CN	OH	OH	General formula (112)	H	H	CH_3	H
415	General formula (112)	CN	OH	OH	General formula (112)	H	H	CH_3O	H
416	OH	CN	General formula (112)	OH	General formula (112)	H	H	H	H
417	OH	CN	General formula (112)	OH	General formula (112)	H	H	CH_3	H
418	OH	CN	General formula (112)	OH	General formula (112)	H	H	CH_3O	H
419	OH	CN	OH	General formula (112)	General formula (112)	H	H	H	H
420	OH	CN	OH	General formula (112)	General formula (112)	H	H	CH_3	H
421	OH	CN	OH	General formula (112)	General formula (112)	H	H	CH_3O	H
422	General formula (112)	CN	OH	OH	OH	H	H	H	H
423	General formula (112)	CN	OH	OH	OH	H	H	CH_3	H
424	General formula (112)	CN	OH	OH	OH	H	H	CH_3O	H
425	OH	CN	General formula (112)	OH	OH	H	H	H	H
426	OH	CN	General formula (112)	OH	OH	H	H	CH_3	H
427	OH	CN	General formula (112)	OH	OH	H	H	CH_3O	H
428	OH	CN	OH	General formula (112)	OH	H	H	H	H
429	OH	CN	OH	General formula (112)	OH	H	H	CH_3	H
430	OH	CN	OH	General formula (112)	OH	H	H	CH_3O	H
431	OH	CN	OH	OH	General formula (112)	H	H	H	H
432	OH	CN	OH	OH	General formula (112)	H	H	CH_3	H
433	OH	CN	OH	OH	General formula (112)	H	H	CH_3O	H
434	General formula (112)	CN	General formula (112)	Cl	General formula (112)	H	H	H	H
435	General formula (112)	CN	General formula (112)	Cl	General formula (112)	H	H	CH_3	H
436	General formula (112)	CN	General formula (112)	Cl	General formula (112)	H	H	CH_3O	H
437	General formula (112)	CN	General formula (112)	Cl	General formula (112)	H	H	t-C_4H_9	H

TABLE 2-continued

Compound	General formula (1)					General formula (112)			
No.	R^1	R^2	R^3	R^4	R^5	R^{31}, R^{38}	R^{32}, R^{37}	R^{33}, R^{36}	R^{34}, R^{35}
438	General formula (112)	CN	General formula (112)	Cl	General formula (112)	H	H	Cl	H
439	General formula (112)	CN	General formula (112)	Cl	General formula (112)	H	H	F	H
440	General formula (112)	CN	General formula (112)	F	General formula (112)	H	H	H	H
441	General formula (112)	CN	General formula (112)	F	General formula (112)	H	H	CH_3	H
442	General formula (112)	CN	General formula (112)	F	General formula (112)	H	H	CH_3O	H
443	General formula (112)	CN	General formula (112)	F	General formula (112)	H	H	t-C_4H_9	H
444	General formula (112)	CN	General formula (112)	F	General formula (112)	H	H	Cl	H
445	General formula (112)	CN	General formula (112)	F	General formula (112)	H	H	F	H
446	General formula (112)	CN	General formula (112)	CH_3O	General formula (112)	H	H	H	H
447	General formula (112)	CN	General formula (112)	CH_3O	General formula (112)	H	H	CH_3	H
448	General formula (112)	CN	General formula (112)	CH_3O	General formula (112)	H	H	CH_3O	H
449	General formula (112)	CN	General formula (112)	CH_3O	General formula (112)	H	H	t-C_4H_9	H
450	General formula (112)	CN	General formula (112)	CH_3O	General formula (112)	H	H	Cl	H
451	General formula (112)	CN	General formula (112)	CH_3O	General formula (112)	H	H	F	H
452	General formula (112)	CN	General formula (112)	C_2H_5O	General formula (112)	H	H	H	H
453	General formula (112)	CN	General formula (112)	C_2H_5O	General formula (112)	H	H	CH_3	H
454	General formula (112)	CN	General formula (112)	C_2H_5O	General formula (112)	H	H	CH_3O	H
455	General formula (112)	CN	General formula (112)	C_2H_5O	General formula (112)	H	H	t-C_4H_9	H
456	General formula (112)	CN	General formula (112)	C_2H_5O	General formula (112)	H	H	Cl	H
457	General formula (112)	CN	General formula (112)	C_2H_5O	General formula (112)	H	H	F	H
458	General formula (112)	CN	General formula (112)	C_6H_5O	General formula (112)	H	H	H	H
459	General formula (112)	CN	General formula (112)	C_6H_5O	General formula (112)	H	H	CH_3	H
460	General formula (112)	CN	General formula (112)	C_6H_5O	General formula (112)	H	H	CH_3O	H
461	General formula (112)	CN	General formula (112)	C_6H_5O	General formula (112)	H	H	t-C_4H_9	H
462	General formula (112)	CN	General formula (112)	C_6H_5O	General formula (112)	H	H	Cl	H
463	General formula (112)	CN	General formula (112)	C_6H_5O	General formula (112)	H	H	F	H
464	General formula (112)	CN	General formula (112)	Formula (121)	General formula (112)	H	H	H	H
465	General formula (112)	CN	General formula (112)	Formula (121)	General formula (112)	H	H	CH_3	H
466	General formula (112)	CN	General formula (112)	Formula (121)	General formula (112)	H	H	CH_3O	H
467	General formula (112)	CN	General formula (112)	Formula (121)	General formula (112)	H	H	t-C_4H_9	H
468	General formula (112)	CN	General formula (112)	Formula (121)	General formula (112)	H	H	Cl	H
469	General formula (112)	CN	General formula (112)	Formula (121)	General formula (112)	H	H	F	H
470	General formula (112)	CN	General formula (112)	Formula (122)	General formula (112)	H	H	H	H
471	General formula (112)	CN	General formula (112)	Formula (122)	General formula (112)	H	H	CH_3	H
472	General formula (112)	CN	General formula (112)	Formula (122)	General formula (112)	H	H	CH_3O	H
473	General formula (112)	CN	General formula (112)	Formula (122)	General formula (112)	H	H	t-C_4H_9	H
474	General formula (112)	CN	General formula (112)	Formula (122)	General formula (112)	H	H	Cl	H

TABLE 2-continued

Compound	General formula (1)					General formula (112)			
No.	R^1	R^2	R^3	R^4	R^5	R^{31}, R^{38}	R^{32}, R^{37}	R^{33}, R^{36}	R^{34}, R^{35}
475	General formula (112)	CN	General formula (112)	Formula (122)	General formula (112)	H	H	F	H
476	General formula (112)	CN	General formula (112)	Formula (123)	General formula (112)	H	H	H	H
477	General formula (112)	CN	General formula (112)	Formula (123)	General formula (112)	H	H	CH_3	H
478	General formula (112)	CN	General formula (112)	Formula (123)	General formula (112)	H	H	CH_3O	H
479	General formula (112)	CN	General formula (112)	Formula (123)	General formula (112)	H	H	t-C_4H_9	H
480	General formula (112)	CN	General formula (112)	Formula (123)	General formula (112)	H	H	Cl	H
481	General formula (112)	CN	General formula (112)	Formula (123)	General formula (112)	H	H	F	H
482	General formula (112)	CN	General formula (112)	Formula (124)	General formula (112)	H	H	H	H
483	General formula (112)	CN	General formula (112)	Formula (124)	General formula (112)	H	H	CH_3	H
484	General formula (112)	CN	General formula (112)	Formula (124)	General formula (112)	H	H	CH_3O	H
485	General formula (112)	CN	General formula (112)	Formula (124)	General formula (112)	H	H	t-C_4H_9	H
486	General formula (112)	CN	General formula (112)	Formula (124)	General formula (112)	H	H	Cl	H
487	General formula (112)	CN	General formula (112)	Formula (124)	General formula (112)	H	H	F	H
488	General formula (112)	CN	General formula (112)	General formula (112)	General formula (112)	H	C_6H_5	H	H
489	General formula (112)	CN	General formula (112)	General formula (112)	General formula (112)	H	H	C_6H_5	H
490	General formula (112)	CN	General formula (112)	General formula (112)	H	H	C_6H_5	H	H
491	General formula (112)	CN	General formula (112)	General formula (112)	H	H	H	C_6H_5	H
492	General formula (112)	CN	General formula (112)	H	General formula (112)	H	C_6H_5	H	H
493	General formula (112)	CN	General formula (112)	H	General formula (112)	H	H	C_6H_5	H
494	General formula (112)	CN	H	General formula (112)	General formula (112)	H	C_6H_5	H	H
495	General formula (112)	CN	H	General formula (112)	General formula (112)	H	H	C_6H_5	H
496	H	CN	General formula (112)	General formula (112)	General formula (112)	H	C_6H_5	H	H
497	H	CN	General formula (112)	General formula (112)	General formula (112)	H	H	C_6H_5	H
498	General formula (112)	CN	General formula (112)	H	H	H	C_6H_5	H	H
499	General formula (112)	CN	General formula (112)	H	H	H	H	C_6H_5	H
500-1	General formula (112)	CN	H	General formula (112)	H	H	C_6H_5	H	H
500-2	General formula (112)	CN	H	General formula (112)	H	H	H	C_6H_5	H
500-3	H	CN	General formula (112)	General formula (112)	H	H	C_6H_5	H	H
500-4	H	CN	General formula (112)	General formula (112)	H	H	H	C_6H_5	H
500-5	General formula (112)	CN	H	H	General formula (112)	H	C_6H_5	H	H
500-6	General formula (112)	CN	H	H	General formula (112)	H	H	C_6H_5	H
500-7	H	CN	General formula (112)	H	General formula (112)	H	C_6H_5	H	H
500-8	H	CN	General formula (112)	H	General formula (112)	H	H	C_6H_5	H
500-9	H	CN	H	General formula (112)	General formula (112)	H	C_6H_5	H	H
500-10	H	CN	H	General formula (112)	General formula (112)	H	H	C_6H_5	H
500-11	General formula (112)	CN	H	H	H	H	C_6H_5	H	H

TABLE 2-continued

Compound	General formula (1)					General formula (112)			
No.	R^1	R^2	R^3	R^4	R^5	R^{31}, R^{38}	R^{32}, R^{37}	R^{33}, R^{36}	R^{34}, R^{35}
500-12	General formula (112)	CN	H	H	H	H	H	C_6H_5	H
500-13	H	CN	General formula (112)	H	H	H	C_6H_5	H	H
500-14	H	CN	General formula (112)	H	H	H	H	C_6H_5	H
500-15	H	CN	H	General formula (112)	H	H	C_6H_5	H	H
500-16	H	CN	H	General formula (112)	H	H	H	C_6H_5	H
500-17	General formula (112)	CN	General formula (112)	General formula (112)	F	H	H	C_6H_5	H
500-18	General formula (112)	CN	General formula (112)	F	General formula (112)	H	H	C_6H_5	H
500-19	General formula (112)	CN	F	General formula (112)	General formula (112)	H	H	C_6H_5	H
500-20	F	CN	General formula (112)	General formula (112)	General formula (112)	H	H	C_6H_5	H
500-21	General formula (112)	CN	General formula (112)	F	F	H	H	C_6H_5	H
500-22	General formula (112)	CN	F	General formula (112)	F	H	H	C_6H_5	H
500-23	F	CN	General formula (112)	General formula (112)	F	H	H	C_6H_5	H
500-24	General formula (112)	CN	F	F	General formula (112)	H	H	C_6H_5	H
500-25	F	CN	General formula (112)	F	General formula (112)	H	H	C_6H_5	H
500-26	F	CN	F	General formula (112)	General formula (112)	H	H	C_6H_5	H
500-27	General formula (112)	CN	F	F	F	H	H	C_6H_5	H
500-28	F	CN	General formula (112)	F	F	H	H	C_6H_5	H
500-29	F	CN	F	General formula (112)	F	H	H	C_6H_5	H
500-30	General formula (112)	CN	General formula (112)	General formula (112)	OH	H	H	C_6H_5	H
500-31	General formula (112)	CN	General formula (112)	OH	General formula (112)	H	H	C_6H_5	H
500-32	General formula (112)	CN	OH	General formula (112)	General formula (112)	H	H	C_6H_5	H
500-33	OH	CN	General formula (112)	General formula (112)	General formula (112)	H	H	C_6H_5	H
500-34	General formula (112)	CN	General formula (112)	OH	OH	H	H	C_6H_5	H
500-35	General formula (112)	CN	OH	General formula (112)	OH	H	H	C_6H_5	H
500-36	OH	CN	General formula (112)	General formula (112)	OH	H	H	C_6H_5	H
500-37	General formula (112)	CN	OH	OH	General formula (112)	H	H	C_6H_5	H
500-38	OH	CN	General formula (112)	OH	General formula (112)	H	H	C_6H_5	H
500-39	OH	CN	OH	General formula (112)	General formula (112)	H	H	C_6H_5	H
500-40	General formula (112)	CN	OH	OH	OH	H	H	C_6H_5	H
500-41	OH	CN	General formula (112)	OH	OH	H	H	C_6H_5	H
500-42	OH	CN	OH	General formula (112)	OH	H	H	C_6H_5	H
500-43	OH	CN	OH	OH	General formula (112)	H	H	C_6H_5	H
500-44	General formula (112)	CN	General formula (112)	Cl	General formula (112)	H	H	C_6H_5	H
500-45	General formula (112)	CN	General formula (112)	F	General formula (112)	H	H	C_6H_5	H
500-46	General formula (112)	CN	General formula (112)	CH_3O	General formula (112)	H	H	C_6H_5	H
500-47	General formula (112)	CN	General formula (112)	C_2H_5O	General formula (112)	H	H	C_6H_5	H
500-48	General formula (112)	CN	General formula (112)	C_6H_5O	General formula (112)	H	H	C_6H_5	H

TABLE 2-continued

Compound	General formula (1)					General formula (112)			
No.	R^1	R^2	R^3	R^4	R^5	R^{31}, R^{38}	R^{32}, R^{37}	R^{33}, R^{36}	R^{34}, R^{35}
500-49	General formula (112)	CN	General formula (112)	Formula (121)	General formula (112)	H	H	C_6H_5	H
500-50	General formula (112)	CN	General formula (112)	Formula (122)	General formula (112)	H	H	C_6H_5	H
500-51	General formula (112)	CN	General formula (112)	Formula (123)	General formula (112)	H	H	C_6H_5	H
500-52	General formula (112)	CN	General formula (112)	Formula (124)	General formula (112)	H	H	C_6H_5	H

TABLE 3

Compound	General formula (1)					General formula (112)			
No.	R^1	R^2	R^3	R^4	R^5	R^{31}, R^{38}	R^{32}, R^{37}	R^{33}, R^{36}	R^{34}, R^{35}
501	CN	General formula (112)	General formula (112)	General formula (112)	General formula (112)	H	H	H	H
502	CN	General formula (112)	General formula (112)	General formula (112)	General formula (112)	H	CH_3	H	H
503	CN	General formula (112)	General formula (112)	General formula (112)	General formula (112)	H	CH_3O	H	H
504	CN	General formula (112)	General formula (112)	General formula (112)	General formula (112)	H	H	CH_3	H
505	CN	General formula (112)	General formula (112)	General formula (112)	General formula (112)	H	H	CH_3O	H
506	CN	General formula (112)	General formula (112)	General formula (112)	General formula (112)	H	H	t-C_4H_9	H
507	CN	General formula (112)	General formula (112)	General formula (112)	General formula (112)	H	H	Cl	H
508	CN	General formula (112)	General formula (112)	General formula (112)	General formula (112)	H	H	F	H
509	CN	General formula (112)	General formula (112)	General formula (112)	General formula (112)	H	H	H	CH_3
510	CN	General formula (112)	General formula (112)	General formula (112)	General formula (112)	H	H	H	CH_3O
511	CN	General formula (112)	General formula (112)	General formula (112)	H	H	H	H	H
512	CN	General formula (112)	General formula (112)	General formula (112)	H	H	H	CH_3	H
513	CN	General formula (112)	General formula (112)	General formula (112)	H	H	H	CH_3O	H
514	CN	General formula (112)	General formula (112)	H	General formula (112)	H	H	H	H
515	CN	General formula (112)	General formula (112)	H	General formula (112)	H	H	CH_3	H
516	CN	General formula (112)	General formula (112)	H	General formula (112)	H	H	CH_3O	H
517	CN	General formula (112)	General formula (112)	H	H	H	H	H	H
518	CN	General formula (112)	General formula (112)	H	H	H	H	CH_3	H
519	CN	General formula (112)	General formula (112)	H	H	H	H	CH_3O	H
520	CN	General formula (112)	H	General formula (112)	H	H	H	H	H
521	CN	General formula (112)	H	General formula (112)	H	H	H	CH_3	H
522	CN	General formula (112)	H	General formula (112)	H	H	H	CH_3O	H
523	CN	H	General formula (112)	General formula (112)	H	H	H	H	H
524	CN	H	General formula (112)	General formula (112)	H	H	H	CH_3	H
525	CN	H	General formula (112)	General formula (112)	H	H	H	CH_3O	H
526	CN	General formula (112)	H	H	General formula (112)	H	H	H	H
527	CN	General formula (112)	H	H	General formula (112)	H	H	CH_3	H
528	CN	General formula (112)	H	H	General formula (112)	H	H	CH_3O	H
529	CN	General formula (112)	H	H	H	H	H	H	H
530	CN	General formula (112)	H	H	H	H	H	CH_3	H
531	CN	General formula (112)	H	H	H	H	H	CH_3O	H
532	CN	H	General formula (112)	H	H	H	H	H	H
533	CN	H	General formula (112)	H	H	H	H	CH_3	H
534	CN	H	General formula (112)	H	H	H	H	CH_3O	H
535	CN	General formula (112)	General formula (112)	General formula (112)	F	H	H	H	H
536	CN	General formula (112)	General formula (112)	General formula (112)	F	H	H	CH_3	H
537	CN	General formula (112)	General formula (112)	General formula (112)	F	H	H	CH_3O	H
538	CN	General formula (112)	General formula (112)	F	General formula (112)	H	H	H	H
539	CN	General formula (112)	General formula (112)	F	General formula (112)	H	H	CH_3	H
540	CN	General formula (112)	General formula (112)	F	General formula (112)	H	H	CH_3O	H
541	CN	General formula (112)	General formula (112)	F	F	H	H	H	H
542	CN	General formula (112)	General formula (112)	F	F	H	H	CH_3	H
543	CN	General formula (112)	General formula (112)	F	F	H	H	CH_3O	H
544	CN	General formula (112)	F	General formula (112)	F	H	H	H	H
545	CN	General formula (112)	F	General formula (112)	F	H	H	CH_3	H
546	CN	General formula (112)	F	General formula (112)	F	H	H	CH_3O	H
547	CN	F	General formula (112)	General formula (112)	F	H	H	H	H
548	CN	F	General formula (112)	General formula (112)	F	H	H	CH_3	H
549	CN	F	General formula (112)	General formula (112)	F	H	H	CH_3O	H
550	CN	General formula (112)	F	F	General formula (112)	H	H	H	H
551	CN	General formula (112)	F	F	General formula (112)	H	H	CH_3	H
552	CN	General formula (112)	F	F	General formula (112)	H	H	CH_3O	H
553	CN	General formula (112)	F	F	F	H	H	H	H
554	CN	General formula (112)	F	F	F	H	H	CH_3	H
555	CN	General formula (112)	F	F	F	H	H	CH_3O	H

TABLE 3-continued

Compound	General formula (1)					General formula (112)			
No.	R^1	R^2	R^3	R^4	R^5	R^{31}, R^{38}	R^{32}, R^{37}	R^{33}, R^{36}	R^{34}, R^{35}
556	CN	F	General formula (112)	F	F	H	H	H	H
557	CN	F	General formula (112)	F	F	H	H	CH_3	H
558	CN	F	General formula (112)	F	F	H	H	CH_3O	H
559	CN	General formula (112)	General formula (112)	General formula (112)	OH	H	H	H	H
560	CN	General formula (112)	General formula (112)	General formula (112)	OH	H	H	CH_3	H
561	CN	General formula (112)	General formula (112)	General formula (112)	OH	H	H	CH_3O	H
562	CN	General formula (112)	General formula (112)	OH	General formula (112)	H	H	H	H
563	CN	General formula (112)	General formula (112)	OH	General formula (112)	H	H	CH_3	H
564	CN	General formula (112)	General formula (112)	OH	General formula (112)	H	H	CH_3O	H
565	CN	General formula (112)	General formula (112)	OH	General formula (112)	H	H	Cl	H
566	CN	General formula (112)	General formula (112)	OH	General formula (112)	H	H	F	H
567	CN	General formula (112)	General formula (112)	OH	OH	H	H	H	H
568	CN	General formula (112)	General formula (112)	OH	OH	H	H	CH_3	H
569	CN	General formula (112)	General formula (112)	OH	OH	H	H	CH_3O	H
570	CN	General formula (112)	OH	General formula (112)	OH	H	H	H	H
571	CN	General formula (112)	OH	General formula (112)	OH	H	H	CH_3	H
572	CN	General formula (112)	OH	General formula (112)	OH	H	H	CH_3O	H
573	CN	OH	General formula (112)	General formula (112)	OH	H	H	H	H
574	CN	OH	General formula (112)	General formula (112)	OH	H	H	CH_3	H
575	CN	OH	General formula (112)	General formula (112)	OH	H	H	CH_3O	H
576	CN	General formula (112)	OH	OH	General formula (112)	H	H	H	H
577	CN	General formula (112)	OH	OH	General formula (112)	H	H	CH_3	H
578	CN	General formula (112)	OH	OH	General formula (112)	H	H	CH_3O	H
579	CN	General formula (112)	OH	OH	OH	H	H	H	H
580	CN	General formula (112)	OH	OH	OH	H	H	CH_3	H
581	CN	General formula (112)	OH	OH	OH	H	H	CH_3O	H
582	CN	OH	General formula (112)	OH	OH	H	H	H	H
583	CN	OH	General formula (112)	OH	OH	H	H	CH_3	H
584	CN	OH	General formula (112)	OH	OH	H	H	CH_3O	H
585	CN	General formula (112)	General formula (112)	Cl	General formula (112)	H	H	H	H
586	CN	General formula (112)	General formula (112)	Cl	General formula (112)	H	H	CH_3	H
587	CN	General formula (112)	General formula (112)	Cl	General formula (112)	H	H	CH_3O	H
588	CN	General formula (112)	General formula (112)	Cl	General formula (112)	H	H	t-C_4H_9	H
589	CN	General formula (112)	General formula (112)	Cl	General formula (112)	H	H	Cl	H
590	CN	General formula (112)	General formula (112)	Cl	General formula (112)	H	H	F	H
591	CN	General formula (112)	General formula (112)	F	General formula (112)	H	H	H	H
592	CN	General formula (112)	General formula (112)	F	General formula (112)	H	H	CH_3	H
593	CN	General formula (112)	General formula (112)	F	General formula (112)	H	H	CH_3O	H
594	CN	General formula (112)	General formula (112)	F	General formula (112)	H	H	t-C_4H_9	H
595	CN	General formula (112)	General formula (112)	F	General formula (112)	H	H	Cl	H
596	CN	General formula (112)	General formula (112)	F	General formula (112)	H	H	F	H
597	CN	General formula (112)	General formula (112)	CH_3O	General formula (112)	H	H	H	H
598	CN	General formula (112)	General formula (112)	CH_3O	General formula (112)	H	H	CH_3	H
599	CN	General formula (112)	General formula (112)	CH_3O	General formula (112)	H	H	CH_3O	H
600	CN	General formula (112)	General formula (112)	CH_3O	General formula (112)	H	H	t-C_4H_9	H
601	CN	General formula (112)	General formula (112)	CH_3O	General formula (112)	H	H	Cl	H
602	CN	General formula (112)	General formula (112)	CH_3O	General formula (112)	H	H	F	H
603	CN	General formula (112)	General formula (112)	C_2H_5O	General formula (112)	H	H	H	H
604	CN	General formula (112)	General formula (112)	C_2H_5O	General formula (112)	H	H	CH_3	H
605	CN	General formula (112)	General formula (112)	C_2H_5O	General formula (112)	H	H	CH_3O	H
606	CN	General formula (112)	General formula (112)	C_3H_5O	General formula (112)	H	H	t-C_4H_9	H
607	CN	General formula (112)	General formula (112)	C_2H_5O	General formula (112)	H	H	Cl	H
608	CN	General formula (112)	General formula (112)	C_2H_5O	General formula (112)	H	H	F	H
609	CN	General formula (112)	General formula (112)	C_6H_5O	General formula (112)	H	H	H	H
610	CN	General formula (112)	General formula (112)	C_6H_5O	General formula (112)	H	H	CH_3	H
611	CN	General formula (112)	General formula (112)	C_6H_5O	General formula (112)	H	H	CH_3O	H
612	CN	General formula (112)	General formula (112)	C_6H_5O	General formula (112)	H	H	t-C_4H_9	H
613	CN	General formula (112)	General formula (112)	C_6H_5O	General formula (112)	H	H	Cl	H
614	CN	General formula (112)	General formula (112)	C_6H_5O	General formula (112)	H	H	F	H
615	CN	General formula (112)	General formula (112)	Formula (121)	General formula (112)	H	H	H	H
616	CN	General formula (112)	General formula (112)	Formula (121)	General formula (112)	H	H	CH_3	H
617	CN	General formula (112)	General formula (112)	Formula (121)	General formula (112)	H	H	CH_3O	H
618	CN	General formula (112)	General formula (112)	Formula (121)	General formula (112)	H	H	t-C_4H_9	H
619	CN	General formula (112)	General formula (112)	Formula (121)	General formula (112)	H	H	Cl	H
620	CN	General formula (112)	General formula (112)	Formula (121)	General formula (112)	H	H	F	H
621	CN	General formula (112)	General formula (112)	Formula (122)	General formula (112)	H	H	H	H
622	CN	General formula (112)	General formula (112)	Formula (122)	General formula (112)	H	H	CH_3	H
623	CN	General formula (112)	General formula (112)	Formula (122)	General formula (112)	H	H	CH_3O	H
624	CN	General formula (112)	General formula (112)	Formula (122)	General formula (112)	H	H	t-C_4H_9	H
625	CN	General formula (112)	General formula (112)	Formula (122)	General formula (112)	H	H	Cl	H
626	CN	General formula (112)	General formula (112)	Formula (122)	General formula (112)	H	H	F	H
627	CN	General formula (112)	General formula (112)	Formula (123)	General formula (112)	H	H	H	H
628	CN	General formula (112)	General formula (112)	Formula (123)	General formula (112)	H	H	CH_3	H

TABLE 3-continued

Compound	General formula (1)					General formula (112)			
No.	R^1	R^2	R^3	R^4	R^5	R^{31}, R^{38}	R^{32}, R^{37}	R^{33}, R^{36}	R^{34}, R^{35}
629	CN	General formula (112)	General formula (112)	Formula (123)	General formula (112)	H	H	CH_3O	H
630	CN	General formula (112)	General formula (112)	Formula (123)	General formula (112)	H	H	t-C_4H_9	H
631	CN	General formula (112)	General formula (112)	Formula (123)	General formula (112)	H	H	Cl	H
632	CN	General formula (112)	General formula (112)	Formula (123)	General formula (112)	H	H	F	H
633	CN	General formula (112)	General formula (112)	Formula (124)	General formula (112)	H	H	H	H
634	CN	General formula (112)	General formula (112)	Formula (124)	General formula (112)	H	H	CH_3	H
635	CN	General formula (112)	General formula (112)	Formula (124)	General formula (112)	H	H	CH_3O	H
636	CN	General formula (112)	General formula (112)	Formula (124)	General formula (112)	H	H	t-C_4H_9	H
637	CN	General formula (112)	General formula (112)	Formula (124)	General formula (112)	H	H	Cl	H
638	CN	General formula (112)	General formula (112)	Formula (124)	General formula (112)	H	H	F	H
639	CN	General formula (112)	General formula (112)	General formula (112)	General formula (112)	H	C_6H_5	H	H
640	CN	General formula (112)	General formula (112)	General formula (112)	General formula (112)	H	H	C_6H_5	H
641	CN	General formula (112)	General formula (112)	General formula (112)	H	H	C_6H_5	H	H
642	CN	General formula (112)	General formula (112)	General formula (112)	H	H	H	C_6H_5	H
643	CN	General formula (112)	General formula (112)	H	General formula (112)	H	C_6H_5	H	H
644	CN	General formula (112)	General formula (112)	H	General formula (112)	H	H	C_6H_5	H
645	CN	General formula (112)	General formula (112)	H	H	H	C_6H_5	H	H
646	CN	General formula (112)	General formula (112)	H	H	H	H	C_6H_5	H
647	CN	General formula (112)	H	General formula (112)	H	H	C_6H_5	H	H
648	CN	General formula (112)	H	General formula (112)	H	H	H	C_6H_5	H
649	CN	H	General formula (112)	General formula (112)	H	H	C_6H_5	H	H
650	CN	H	General formula (112)	General formula (112)	H	H	H	C_6H_5	H
651	CN	H	H	General formula (112)	General formula (112)	H	C_6H_5	H	H
652	CN	H	H	General formula (112)	General formula (112)	H	H	C_6H_5	H
653	CN	General formula (112)	H	H	H	H	C_6H_5	H	H
654	CN	General formula (112)	H	H	H	H	H	C_6H_5	H
655	CN	H	General formula (112)	H	H	H	C_6H_5	H	H
656	CN	H	General formula (112)	H	H	H	H	C_6H_5	H
657	CN	General formula (112)	General formula (112)	General formula (112)	F	H	H	C_6H_5	H
658	CN	General formula (112)	General formula (112)	F	General formula (112)	H	H	C_6H_5	H
659	CN	General formula (112)	General formula (112)	F	F	H	H	C_6H_5	H
660	CN	General formula (112)	F	General formula (112)	F	H	H	C_6H_5	H
661	CN	F	General formula (112)	General formula (112)	F	H	H	C_6H_5	H
662	CN	F	F	General formula (112)	General formula (112)	H	H	C_6H_5	H
663	CN	General formula (112)	F	F	F	H	H	C_6H_5	H
664	CN	F	General formula (112)	F	F	H	H	C_6H_5	H
665	CN	General formula (112)	General formula (112)	General formula (112)	OH	H	H	C_6H_5	H
666	CN	General formula (112)	General formula (112)	OH	General formula (112)	H	H	C_6H_5	H
667	CN	General formula (112)	General formula (112)	OH	OH	H	H	C_6H_5	H
668	CN	General formula (112)	OH	General formula (112)	OH	H	H	C_6H_5	H
669	CN	OH	General formula (112)	General formula (112)	OH	H	H	C_6H_5	H
670	CN	OH	OH	General formula (112)	General formula (112)	H	H	C_6H_5	H
671	CN	General formula (112)	OH	OH	OH	H	H	C_6H_5	H
672	CN	OH	General formula (112)	OH	OH	H	H	C_6H_5	H
673	CN	General formula (112)	General formula (112)	Cl	General formula (112)	H	H	C_6H_5	H
674	CN	General formula (112)	General formula (112)	F	General formula (112)	H	H	C_6H_5	H
675	CN	General formula (112)	General formula (112)	CH_3O	General formula (112)	H	H	C_6H_5	H
676	CN	General formula (112)	General formula (112)	C_2H_5O	General formula (112)	H	H	C_6H_5	H
677	CN	General formula (112)	General formula (112)	C_6H_5O	General formula (112)	H	H	C_6H_5	H
678	CN	General formula (112)	General formula (112)	Formula (121)	General formula (112)	H	H	C_6H_5	H
679	CN	General formula (112)	General formula (112)	Formula (122)	General formula (112)	H	H	C_6H_5	H
680	CN	General formula (112)	General formula (112)	Formula (123)	General formula (112)	H	H	C_6H_5	H
681	CN	General formula (112)	General formula (112)	Formula (124)	General formula (112)	H	H	C_6H_5	H

TABLE 4

	General formula (1)					General formula (113)					
Compound No.	R^1	R^2	R^3	R^4	R^5	R^{41}	R^{42}	R^{43}	R^{44}	R^{45}	R^{46}
701	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	H	H	H	H
702	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	CH_3	H	H	H	H
703	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	CH_3O	H	H	H	H
704	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	CH_3	H	H	H
705	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	CH_3O	H	H	H
706	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	t-C_4H_9	H	H	H
707	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	Cl	H	H	H
708	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	F	H	H	H
709	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	H	CH_3	H	H
710	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	H	CH_3O	H	H
711	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	H	H	CH_3	H
712	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	H	H	CH_3O	H
713	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	H	H	t-C_4H_9	H
714	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	H	H	Cl	H
715	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	H	H	F	H
716	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	H	H	C_6H_5	H
717	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	H	H	p-$CH_3C_6H_4$	H
718	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	H	H	2,4,6-$(CH_3)_3C_6H_2$	H
719	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	H	H	p-$CH_3OC_6H_4$	H
720	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	H	H	p-$(CH_3)_2NC_6H_4$	H
721	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	H	H	p-FC_6H_4	H
722	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	H	H	p-CNC_6H_4	H
723	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	H	H	H	CH_3
724	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	H	H	H	CH_3O
725	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	H	H	H	t-C_4H_9
726	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	H	H	H	Cl
727	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	H	H	H	F
728	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	H	H	H	C_6H_5
729	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	H	H	H	p-$CH_3C_6H_4$
730	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	H	H	H	2,4,6-$(CH_3)_3C_6H_2$
731	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	H	H	H	p-$CH_3OC_6H_4$
732	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	H	H	H	p-$(CH_3)_2NC_6H_4$
733	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	H	H	H	p-FC_6H_4
734	General formula (113)	General formula (113)	CN	General formula (113)	General formula (113)	H	H	H	H	H	p-CNC_6H_4
735	General formula (113)	General formula (113)	CN	General formula (113)	H	H	H	H	H	H	H
736	General formula (113)	General formula (113)	CN	H	General formula (113)	H	H	H	H	H	H
737	General formula (113)	General formula (113)	CN	H	H	H	H	H	H	H	H
738	General formula (113)	H	CN	General formula (113)	H	H	H	H	H	H	H
739	H	General formula (113)	CN	General formula (113)	H	H	H	H	H	H	H
740	General formula (113)	H	CN	H	H	H	H	H	H	H	H
741	General formula (113)	General formula (113)	CN	General formula (113)	F	H	H	H	H	H	H

TABLE 4-continued

Compound No.	General formula (1)					General formula (113)					
	R^1	R^2	R^3	R^4	R^5	R^{41}	R^{42}	R^{43}	R^{44}	R^{45}	R^{46}
742	General formula (113)	General formula (113)	CN	F	General formula (113)	H	H	H	H	H	H
743	General formula (113)	General formula (113)	CN	F	F	H	H	H	H	H	H
744	General formula (113)	F	CN	General formula (113)	F	H	H	H	H	H	H
745	F	General formula (113)	CN	General formula (113)	F	H	H	H	H	H	H
746	General formula (113)	F	CN	F	F	H	H	H	H	H	H
747	General formula (113)	General formula (113)	CN	General formula (113)	OH	H	H	H	H	H	H
748	General formula (113)	General formula (113)	CN	OH	General formula (113)	H	H	H	H	H	H
749	General formula (113)	General formula (113)	CN	OH	OH	H	H	H	H	H	H
750	General formula (113)	OH	CN	General formula (113)	OH	H	H	H	H	H	H
751	OH	General formula (113)	CN	General formula (113)	OH	H	H	H	H	H	H
752	General formula (113)	OH	CN	OH	OH	H	H	H	H	H	H
753	General formula (113)	General formula (113)	CN	Cl	General formula (113)	H	H	H	H	H	H
754	General formula (113)	General formula (113)	CN	Cl	General formula (113)	H	H	CH_3	H	H	H
755	General formula (113)	General formula (113)	CN	Cl	General formula (113)	H	H	CH_3O	H	H	H
756	General formula (113)	General formula (113)	CN	Cl	General formula (113)	H	H	t-C_4H_9	H	H	H
757	General formula (113)	General formula (113)	CN	Cl	General formula (113)	H	H	Cl	H	H	H
758	General formula (113)	General formula (113)	CN	Cl	General formula (113)	H	H	F	H	H	H
759	General formula (113)	General formula (113)	CN	F	General formula (113)	H	H	H	H	H	H
760	General formula (113)	General formula (113)	CN	F	General formula (113)	H	H	CH_3	H	H	H
761	General formula (113)	General formula (113)	CN	F	General formula (113)	H	H	CH_3O	H	H	H
762	General formula (113)	General formula (113)	CN	F	General formula (113)	H	H	t-C_4H_9	H	H	H
763	General formula (113)	General formula (113)	CN	F	General formula (113)	H	H	Cl	H	H	H
764	General formula (113)	General formula (113)	CN	F	General formula (113)	H	H	F	H	H	H
765	General formula (113)	General formula (113)	CN	CH_3O	General formula (113)	H	H	H	H	H	H
766	General formula (113)	General formula (113)	CN	CH_3O	General formula (113)	H	H	CH_3	H	H	H
767	General formula (113)	General formula (113)	CN	CH_3O	General formula (113)	H	H	CH_3O	H	H	H
768	General formula (113)	General formula (113)	CN	CH_3O	General formula (113)	H	H	t-C_4H_9	H	H	H
769	General formula (113)	General formula (113)	CN	CH_3O	General formula (113)	H	H	Cl	H	H	H
770	General formula (113)	General formula (113)	CN	CH_3O	General formula (113)	H	H	F	H	H	H
771	General formula (113)	General formula (113)	CN	C_2H_5O	General formula (113)	H	H	H	H	H	H
772	General formula (113)	General formula (113)	CN	C_2H_5O	General formula (113)	H	H	CH_3	H	H	H
773	General formula (113)	General formula (113)	CN	C_2H_5O	General formula (113)	H	H	CH_3O	H	H	H
774	General formula (113)	General formula (113)	CN	C_2H_5O	General formula (113)	H	H	t-C_4H_9	H	H	H
775	General formula (113)	General formula (113)	CN	C_2H_5O	General formula (113)	H	H	Cl	H	H	H
776	General formula (113)	General formula (113)	CN	C_2H_5O	General formula (113)	H	H	F	H	H	H
777	General formula (113)	General formula (113)	CN	C_6H_5O	General formula (113)	H	H	H	H	H	H
778	General formula (113)	General formula (113)	CN	C_6H_5O	General formula (113)	H	H	CH_3	H	H	H
779	General formula (113)	General formula (113)	CN	C_6H_5O	General formula (113)	H	H	CH_3O	H	H	H
780	General formula (113)	General formula (113)	CN	C_6H_5O	General formula (113)	H	H	t-C_4H_9	H	H	H
781	General formula (113)	General formula (113)	CN	C_6H_5O	General formula (113)	H	H	Cl	H	H	H
782	General formula (113)	General formula (113)	CN	C_6H_5O	General formula (113)	H	H	F	H	H	H
783	General formula (113)	General formula (113)	CN	Formula (121)	General formula (113)	H	H	H	H	H	H

TABLE 4-continued

Compound No.	General formula (1)					General formula (113)					
	R^1	R^2	R^3	R^4	R^5	R^{41}	R^{42}	R^{43}	R^{44}	R^{45}	R^{46}
784	General formula (113)	General formula (113)	CN	Formula (121)	General formula (113)	H	H	CH_3	H	H	H
785	General formula (113)	General formula (113)	CN	Formula (121)	General formula (113)	H	H	CH_3O	H	H	H
786	General formula (113)	General formula (113)	CN	Formula (121)	General formula (113)	H	H	t-C_4H_9	H	H	H
787	General formula (113)	General formula (113)	CN	Formula (121)	General formula (113)	H	H	Cl	H	H	H
788	General formula (113)	General formula (113)	CN	Formula (121)	General formula (113)	H	H	F	H	H	H
789	General formula (113)	General formula (113)	CN	Formula (122)	General formula (113)	H	H	H	H	H	H
790	General formula (113)	General formula (113)	CN	Formula (122)	General formula (113)	H	H	CH_3	H	H	H
791	General formula (113)	General formula (113)	CN	Formula (122)	General formula (113)	H	H	CH_3O	H	H	H
792	General formula (113)	General formula (113)	CN	Formula (122)	General formula (113)	H	H	t-C_4H_9	H	H	H
793	General formula (113)	General formula (113)	CN	Formula (122)	General formula (113)	H	H	Cl	H	H	H
794	General formula (113)	General formula (113)	CN	Formula (122)	General formula (113)	H	H	F	H	H	H
795	General formula (113)	General formula (113)	CN	Formula (123)	General formula (113)	H	H	H	H	H	H
796	General formula (113)	General formula (113)	CN	Formula (123)	General formula (113)	H	H	CH_3	H	H	H
797	General formula (113)	General formula (113)	CN	Formula (123)	General formula (113)	H	H	CH_3O	H	H	H
798	General formula (113)	General formula (113)	CN	Formula (123)	General formula (113)	H	H	t-C_4H_9	H	H	H
799	General formula (113)	General formula (113)	CN	Formula (123)	General formula (113)	H	H	Cl	H	H	H
800	General formula (113)	General formula (113)	CN	Formula (123)	General formula (113)	H	H	F	H	H	H
801	General formula (113)	General formula (113)	CN	Formula (124)	General formula (113)	H	H	H	H	H	H
802	General formula (113)	General formula (113)	CN	Formula (124)	General formula (113)	H	H	CH_3	H	H	H
803	General formula (113)	General formula (113)	CN	Formula (124)	General formula (113)	H	H	CH_3O	H	H	H
804	General formula (113)	General formula (113)	CN	Formula (124)	General formula (113)	H	H	t-C_4H_9	H	H	H
805	General formula (113)	General formula (113)	CN	Formula (124)	General formula (113)	H	H	Cl	H	H	H
806	General formula (113)	General formula (113)	CN	Formula (124)	General formula (113)	H	H	F	H	H	H

TABLE 5

Compound	General formula (1)					General formula (114)							
No.	R^1	R^2	R^3	R^4	R^5	R^{52}	R^{53}	R^{54}	R^{55}	R^{57}	R^{59}	R^{61}	R^{51}, R^{56}, R^{58}, R^{60}, R^{62}
901	General formula (114)	General formula (114)	CN	General formula (114)	General formula (114)	H	H	H	H	H	H	H	H
902	General formula (114)	General formula (114)	CN	General formula (114)	General formula (114)	CH_3	H	H	H	H	H	H	H
903	General formula (114)	General formula (114)	CN	General formula (114)	General formula (114)	CH_3O	H	H	H	H	H	H	H
904	General formula (114)	General formula (114)	CN	General formula (114)	General formula (114)	H	CH_3	H	H	H	H	H	H
905	General formula (114)	General formula (114)	CN	General formula (114)	General formula (114)	H	CH_3O	H	H	H	H	H	H
906	General formula (114)	General formula (114)	CN	General formula (114)	General formula (114)	H	t-C_4H_9	H	H	H	H	H	H
907	General formula (114)	General formula (114)	CN	General formula (114)	General formula (114)	H	Cl	H	H	H	H	H	H
908	General formula (114)	General formula (114)	CN	General formula (114)	General formula (114)	H	F	H	H	H	H	H	H
909	General formula (114)	General formula (114)	CN	General formula (114)	General formula (114)	H	H	CH_3	H	H	H	H	H
910	General formula (114)	General formula (114)	CN	General formula (114)	General formula (114)	H	H	CH_3O	H	H	H	H	H
911	General formula (114)	General formula (114)	CN	General formula (114)	General formula (114)	H	H	H	CH_3	H	H	H	H
912	General formula (114)	General formula (114)	CN	General formula (114)	General formula (114)	H	H	H	CH_3O	H	H	H	H
913	General formula (114)	General formula (114)	CN	General formula (114)	General formula (114)	H	H	H	H	CH_3	H	H	H
914	General formula (114)	General formula (114)	CN	General formula (114)	General formula (114)	H	H	H	H	CH_3O	H	H	H
915	General formula (114)	General formula (114)	CN	General formula (114)	General formula (114)	H	H	H	H	H	CH_3	H	H
916	General formula (114)	General formula (114)	CN	General formula (114)	General formula (114)	H	H	H	H	H	CH_3O	H	H
917	General formula (114)	General formula (114)	CN	General formula (114)	General formula (114)	H	H	H	H	H	H	CH_3	H
918	General formula (114)	General formula (114)	CN	General formula (114)	General formula (114)	H	H	H	H	H	H	CH_3O	H
919	General formula (114)	General formula (114)	CN	General formula (114)	H	H	H	H	H	H	H	H	H
920	General formula (114)	General formula (114)	CN	H	General formula (114)	H	H	H	H	H	H	H	H
921	General formula (114)	General formula (114)	CN	H	H	H	H	H	H	H	H	H	H
922	General formula (114)	H	CN	General formula (114)	H	H	H	H	H	H	H	H	H
923	H	General formula (114)	CN	General formula (114)	H	H	H	H	H	H	H	H	H
924	General formula (114)	H	CN	H	H	H	H	H	H	H	H	H	H
925	General formula (114)	General formula (114)	CN	General formula (114)	F	H	H	H	H	H	H	H	H
926	General formula (114)	General formula (114)	CN	F	General formula (114)	H	H	H	H	H	H	H	H
927	General formula (114)	General formula (114)	CN	F	F	H	H	H	H	H	H	H	H
928	General formula (114)	F	CN	General formula (114)	F	H	H	H	H	H	H	H	H
929	F	General formula (114)	CN	General formula (114)	F	H	H	H	H	H	H	H	H
930	General formula (114)	F	CN	F	F	H	H	H	H	H	H	H	H
931	General formula (114)	General formula (114)	CN	General formula (114)	OH	H	H	H	H	H	H	H	H
932	General formula (114)	General formula (114)	CN	OH	General formula (114)	H	H	H	H	H	H	H	H
933	General formula (114)	General formula (114)	CN	OH	OH	H	H	H	H	H	H	H	H
934	General formula (114)	OH	CN	General formula (114)	OH	H	H	H	H	H	H	H	H
935	OH	General formula (114)	CN	General formula (114)	OH	H	H	H	H	H	H	H	H
936	General formula (114)	OH	CN	OH	OH	H	H	H	H	H	H	H	H
937	General formula (114)	General formula (114)	CN	Cl	General formula (114)	H	H	H	H	H	H	H	H
938	General formula (114)	General formula (114)	CN	Cl	General formula (114)	H	CH_3	H	H	H	H	H	H
939	General formula (114)	General formula (114)	CN	Cl	General formula (114)	H	CH_3O	H	H	H	H	H	H
940	General formula (114)	General formula (114)	CN	Cl	General formula (114)	H	t-C_4H_9	H	H	H	H	H	H
941	General formula (114)	General formula (114)	CN	Cl	General formula (114)	H	Cl	H	H	H	H	H	H
942	General formula (114)	General formula (114)	CN	Cl	General formula (114)	H	F	H	H	H	H	H	H
943	General formula (114)	General formula (114)	CN	F	General formula (114)	H	H	H	H	H	H	H	H
944	General formula (114)	General formula (114)	CN	F	General formula (114)	H	CH_3	H	H	H	H	H	H

TABLE 5-continued

Compound	General formula (1)					General formula (114)							
No.	R^1	R^2	R^3	R^4	R^5	R^{52}	R^{53}	R^{54}	R^{55}	R^{57}	R^{59}	R^{61}	R^{51}, R^{56}, R^{58}, R^{60}, R^{62}
945	General formula (114)	General formula (114)	CN	F	General formula (114)	H	CH_3O	H	H	H	H	H	H
946	General formula (114)	General formula (114)	CN	F	General formula (114)	H	t-C_4H_9	H	H	H	H	H	H
947	General formula (114)	General formula (114)	CN	F	General formula (114)	H	Cl	H	H	H	H	H	H
948	General formula (114)	General formula (114)	CN	F	General formula (114)	H	F	H	H	H	H	H	H
949	General formula (114)	General formula (114)	CN	CH_3O	General formula (114)	H	H	H	H	H	H	H	H
950	General formula (114)	General formula (114)	CN	CH_3O	General formula (114)	H	CH_3	H	H	H	H	H	H
951	General formula (114)	General formula (114)	CN	CH_3O	General formula (114)	H	CH_3O	H	H	H	H	H	H
952	General formula (114)	General formula (114)	CN	CH_3O	General formula (114)	H	t-C_4H_9	H	H	H	H	H	H
953	General formula (114)	General formula (114)	CN	CH_3O	General formula (114)	H	Cl	H	H	H	H	H	H
954	General formula (114)	General formula (114)	CN	CH_3O	General formula (114)	H	F	H	H	H	H	H	H
955	General formula (114)	General formula (114)	CN	C_2H_5O	General formula (114)	H	H	H	H	H	H	H	H
956	General formula (114)	General formula (114)	CN	C_2H_5O	General formula (114)	H	CH_3	H	H	H	H	H	H
957	General formula (114)	General formula (114)	CN	C_2H_5O	General formula (114)	H	CH_3O	H	H	H	H	H	H
958	General formula (114)	General formula (114)	CN	C_2H_5O	General formula (114)	H	t-C_4H_9	H	H	H	H	H	H
959	General formula (114)	General formula (114)	CN	C_2H_5O	General formula (114)	H	Cl	H	H	H	H	H	H
960	General formula (114)	General formula (114)	CN	C_2H_5O	General formula (114)	H	F	H	H	H	H	H	H
961	General formula (114)	General formula (114)	CN	C_6H_5O	General formula (114)	H	H	H	H	H	H	H	H
962	General formula (114)	General formula (114)	CN	C_6H_5O	General formula (114)	H	CH_3	H	H	H	H	H	H
963	General formula (114)	General formula (114)	CN	C_6H_5O	General formula (114)	H	CH_3O	H	H	H	H	H	H
964	General formula (114)	General formula (114)	CN	C_6H_5O	General formula (114)	H	t-C_4H_9	H	H	H	H	H	H
965	General formula (114)	General formula (114)	CN	C_6H_5O	General formula (114)	H	Cl	H	H	H	H	H	H
966	General formula (114)	General formula (114)	CN	C_6H_5O	General formula (114)	H	F	H	H	H	H	H	H
967	General formula (114)	General formula (114)	CN	Formula (121)	General formula (114)	H	H	H	H	H	H	H	H
968	General formula (114)	General formula (114)	CN	Formula (121)	General formula (114)	H	CH_3	H	H	H	H	H	H
969	General formula (114)	General formula (114)	CN	Formula (121)	General formula (114)	H	CH_3O	H	H	H	H	H	H
970	General formula (114)	General formula (114)	CN	Formula (121)	General formula (114)	H	t-C_4H_9	H	H	H	H	H	H
971	General formula (114)	General formula (114)	CN	Formula (121)	General formula (114)	H	Cl	H	H	H	H	H	H
972	General formula (114)	General formula (114)	CN	Formula (121)	General formula (114)	H	F	H	H	H	H	H	H
973	General formula (114)	General formula (114)	CN	Formula (122)	General formula (114)	H	H	H	H	H	H	H	H
974	General formula (114)	General formula (114)	CN	Formula (122)	General formula (114)	H	CH_3	H	H	H	H	H	H
975	General formula (114)	General formula (114)	CN	Formula (122)	General formula (114)	H	CH_3O	H	H	H	H	H	H
976	General formula (114)	General formula (114)	CN	Formula (122)	General formula (114)	H	t-C_4H_9	H	H	H	H	H	H
977	General formula (114)	General formula (114)	CN	Formula (122)	General formula (114)	H	Cl	H	H	H	H	H	H
978	General formula (114)	General formula (114)	CN	Formula (122)	General formula (114)	H	F	H	H	H	H	H	H
989	General formula (114)	General formula (114)	CN	Formula (123)	General formula (114)	H	H	H	H	H	H	H	H
980	General formula (114)	General formula (114)	CN	Formula (123)	General formula (114)	H	CH_3	H	H	H	H	H	H
981	General formula (114)	General formula (114)	CN	Formula (123)	General formula (114)	H	CH_3O	H	H	H	H	H	H
982	General formula (114)	General formula (114)	CN	Formula (123)	General formula (114)	H	t-C_4H_9	H	H	H	H	H	H
983	General formula (114)	General formula (114)	CN	Formula (123)	General formula (114)	H	Cl	H	H	H	H	H	H
984	General formula (114)	General formula (114)	CN	Formula (123)	General formula (114)	H	F	H	H	H	H	H	H
985	General formula (114)	General formula (114)	CN	Formula (124)	General formula (114)	H	H	H	H	H	H	H	H
986	General formula (114)	General formula (114)	CN	Formula (124)	General formula (114)	H	CH_3	H	H	H	H	H	H
987	General formula (114)	General formula (114)	CN	Formula (124)	General formula (114)	H	CH_3O	H	H	H	H	H	H
988	General formula (114)	General formula (114)	CN	Formula (124)	General formula (114)	H	t-C_4H_9	H	H	H	H	H	H
989	General formula (114)	General formula (114)	CN	Formula (124)	General formula (114)	H	Cl	H	H	H	H	H	H
990	General formula (114)	General formula (114)	CN	Formula (124)	General formula (114)	H	F	H	H	H	H	H	H

TABLE 6

Compound No.	General formula (1) R^1	R^2	R^3	R^4	R^5	General formula (115) R^{71}, R^{80}	R^{72}, R^{79}	R^{73}, R^{78}	R^{74}, R^{77}	R^{75}, R^{76}
1001	General formula (115)	General formula (115)	CN	General formula (115)	General formula (115)	H	H	H	H	H
1002	General formula (115)	General formula (115)	CN	General formula (115)	General formula (115)	H	CH_3	H	H	H
1003	General formula (115)	General formula (115)	CN	General formula (115)	General formula (115)	H	CH_3O	H	H	H
1004	General formula (115)	General formula (115)	CN	General formula (115)	General formula (115)	H	C_6H_5	H	H	H
1005	General formula (115)	General formula (115)	CN	General formula (115)	General formula (115)	H	CH_3	H	CH_3	H
1006	General formula (115)	General formula (115)	CN	General formula (115)	General formula (115)	H	CH_3O	H	CH_3O	H
1007	General formula (115)	General formula (115)	CN	General formula (115)	General formula (115)	H	C_6H_5	H	C_6H_5	H
1008	General formula (115)	General formula (115)	CN	General formula (115)	General formula (115)	H	H	CH_3	H	H
1009	General formula (115)	General formula (115)	CN	General formula (115)	General formula (115)	H	H	CH_3O	H	H
1010	General formula (115)	General formula (115)	CN	General formula (115)	General formula (115)	H	H	t-C_4H_9	H	H
1011	General formula (115)	General formula (115)	CN	General formula (115)	General formula (115)	H	H	Cl	H	H
1012	General formula (115)	General formula (115)	CN	General formula (115)	General formula (115)	H	H	F	H	H
1013	General formula (115)	General formula (115)	CN	General formula (115)	General formula (115)	H	H	C_6H_5	H	H
1014	General formula (115)	General formula (115)	CN	General formula (115)	General formula (115)	H	H	p-C_6H_5—C_6H_4	H	H
1015	General formula (115)	General formula (115)	CN	General formula (115)	H	H	H	H	H	H
1016	General formula (115)	General formula (115)	CN	H	General formula (115)	H	H	H	H	H
1017	General formula (115)	General formula (115)	CN	H	H	H	H	H	H	H
1018	General formula (115)	H	CN	General formula (115)	H	H	H	H	H	H
1019	H	General formula (115)	CN	General formula (115)	H	H	H	H	H	H
1020	General formula (115)	H	CN	H	H	H	H	H	H	H
1021	General formula (115)	General formula (115)	CN	General formula (115)	F	H	H	H	H	H
1022	General formula (115)	General formula (115)	CN	F	General formula (115)	H	H	H	H	H
1023	General formula (115)	General formula (115)	CN	F	F	H	H	H	H	H
1024	General formula (115)	F	CN	General formula (115)	F	H	H	H	H	H
1025	F	General formula (115)	CN	General formula (115)	F	H	H	H	H	H
1026	General formula (115)	F	CN	F	F	H	H	H	H	H
1027	General formula (115)	General formula (115)	CN	General formula (115)	OH	H	H	H	H	H
1028	General formula (115)	General formula (115)	CN	OH	General formula (115)	H	H	H	H	H
1029	General formula (115)	General formula (115)	CN	OH	OH	H	H	H	H	H
1030	General formula (115)	OH	CN	General formula (115)	OH	H	H	H	H	H
1031	OH	General formula (115)	CN	General formula (115)	OH	H	H	H	H	H
1032	General formula (115)	OH	CN	OH	OH	H	H	H	H	H
1033	General formula (115)	General formula (115)	CN	Cl	General formula (115)	H	H	H	H	H
1034	General formula (115)	General formula (115)	CN	Cl	General formula (115)	H	H	CH_3	H	H
1035	General formula (115)	General formula (115)	CN	Cl	General formula (115)	H	H	CH_3O	H	H
1036	General formula (115)	General formula (115)	CN	Cl	General formula (115)	H	H	t-C_4H_9	H	H
1037	General formula (115)	General formula (115)	CN	Cl	General formula (115)	H	H	Cl	H	H
1038	General formula (115)	General formula (115)	CN	Cl	General formula (115)	H	H	F	H	H
1039	General formula (115)	General formula (115)	CN	F	General formula (115)	H	H	H	H	H
1040	General formula (115)	General formula (115)	CN	F	General formula (115)	H	H	CH_3	H	H
1041	General formula (115)	General formula (115)	CN	F	General formula (115)	H	H	CH_3O	H	H
1042	General formula (115)	General formula (115)	CN	F	General formula (115)	H	H	t-C_4H_9	H	H
1043	General formula (115)	General formula (115)	CN	F	General formula (115)	H	H	Cl	H	H
1044	General formula (115)	General formula (115)	CN	F	General formula (115)	H	H	F	H	H
1045	General formula (115)	General formula (115)	CN	CH_3O	General formula (115)	H	H	H	H	H
1046	General formula (115)	General formula (115)	CN	CH_3O	General formula (115)	H	H	CH_3	H	H
1047	General formula (115)	General formula (115)	CN	CH_3O	General formula (115)	H	H	CH_3O	H	H
1048	General formula (115)	General formula (115)	CN	CH_3O	General formula (115)	H	H	t-C_4H_9	H	H
1049	General formula (115)	General formula (115)	CN	CH_3O	General formula (115)	H	H	Cl	H	H
1050	General formula (115)	General formula (115)	CN	CH_3O	General formula (115)	H	H	F	H	H
1051	General formula (115)	General formula (115)	CN	C_2H_5O	General formula (115)	H	H	H	H	H
1052	General formula (115)	General formula (115)	CN	C_2H_5O	General formula (115)	H	H	CH_3	H	H
1053	General formula (115)	General formula (115)	CN	C_2H_5O	General formula (115)	H	H	CH_3O	H	H
1054	General formula (115)	General formula (115)	CN	C_2H_5O	General formula (115)	H	H	t-C_4H_9	H	H
1055	General formula (115)	General formula (115)	CN	C_2H_5O	General formula (115)	H	H	Cl	H	H
1056	General formula (115)	General formula (115)	CN	C_2H_5O	General formula (115)	H	H	F	H	H
1057	General formula (115)	General formula (115)	CN	C_6H_5O	General formula (115)	H	H	H	H	H
1058	General formula (115)	General formula (115)	CN	C_6H_5O	General formula (115)	H	H	CH_3	H	H
1059	General formula (115)	General formula (115)	CN	C_6H_5O	General formula (115)	H	H	CH_3O	H	H
1060	General formula (115)	General formula (115)	CN	C_6H_5O	General formula (115)	H	H	t-C_4H_9	H	H
1061	General formula (115)	General formula (115)	CN	C_6H_5O	General formula (115)	H	H	Cl	H	H
1062	General formula (115)	General formula (115)	CN	C_6H_5O	General formula (115)	H	H	F	H	H
1063	General formula (115)	General formula (115)	CN	Formula (121)	General formula (115)	H	H	H	H	H
1064	General formula (115)	General formula (115)	CN	Formula (121)	General formula (115)	H	H	CH_3	H	H
1065	General formula (115)	General formula (115)	CN	Formula (121)	General formula (115)	H	H	CH_3O	H	H
1066	General formula (115)	General formula (115)	CN	Formula (121)	General formula (115)	H	H	t-C_4H_9	H	H
1067	General formula (115)	General formula (115)	CN	Formula (121)	General formula (115)	H	H	Cl	H	H
1068	General formula (115)	General formula (115)	CN	Formula (121)	General formula (115)	H	H	F	H	H
1069	General formula (115)	General formula (115)	CN	Formula (122)	General formula (115)	H	H	H	H	H
1070	General formula (115)	General formula (115)	CN	Formula (122)	General formula (115)	H	H	CH_3	H	H

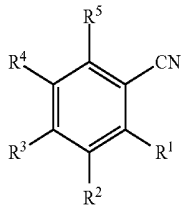
TABLE 6-continued

Compound No.	General formula (1) R^1	R^2	R^3	R^4	R^5	General formula (115) R^{71}, R^{80}	R^{72}, R^{79}	R^{73}, R^{78}	R^{74}, R^{77}	R^{75}, R^{76}
1071	General formula (115)	General formula (115)	CN	Formula (122)	General formula (115)	H	H	CH_3O	H	H
1072	General formula (115)	General formula (115)	CN	Formula (122)	General formula (115)	H	H	t-C_4H_9	H	H
1073	General formula (115)	General formula (115)	CN	Formula (122)	General formula (115)	H	H	Cl	H	H
1074	General formula (115)	General formula (115)	CN	Formula (122)	General formula (115)	H	H	F	H	H
1075	General formula (115)	General formula (115)	CN	Formula (123)	General formula (115)	H	H	H	H	H
1076	General formula (115)	General formula (115)	CN	Formula (123)	General formula (115)	H	H	CH_3	H	H
1077	General formula (115)	General formula (115)	CN	Formula (123)	General formula (115)	H	H	CH_3O	H	H
1078	General formula (115)	General formula (115)	CN	Formula (123)	General formula (115)	H	H	t-C_4H_9	H	H
1079	General formula (115)	General formula (115)	CN	Formula (123)	General formula (115)	H	H	Cl	H	H
1080	General formula (115)	General formula (115)	CN	Formula (123)	General formula (115)	H	H	F	H	H
1081	General formula (115)	General formula (115)	CN	Formula (124)	General formula (115)	H	H	H	H	H
1082	General formula (115)	General formula (115)	CN	Formula (124)	General formula (115)	H	H	CH_3	H	H
1083	General formula (115)	General formula (115)	CN	Formula (124)	General formula (115)	H	H	CH_3O	H	H
1084	General formula (115)	General formula (115)	CN	Formula (124)	General formula (115)	H	H	t-C_4H_9	H	H
1085	General formula (115)	General formula (115)	CN	Formula (124)	General formula (115)	H	H	Cl	H	H
1086	General formula (115)	General formula (115)	CN	Formula (124)	General formula (115)	H	H	F	H	H

[0100] Examples of the preferred light-emitting material include the following compounds.

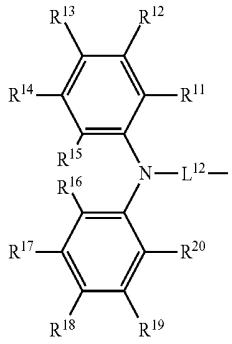
[0101] (1) A compound represented by the following general formula (131):

General Formula (131)



wherein in the general formula (131), front 0 to 1 of R^1 to R^8 represents a cyano group, from 1 to 5 of R^1 to R^5 each represent a group represented by the following general formula (132), and the balance of R^1 to R^5 each represent a hydrogen atom or a substituent other than the above.

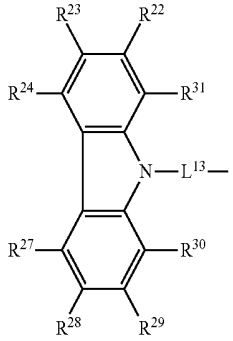
General Formula (132)



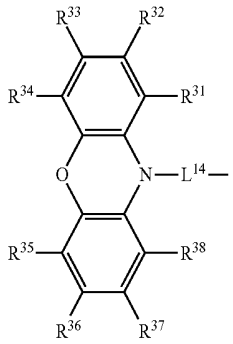
wherein in the general formula (132), R^{11} to R^{20} each independently represent a hydrogen atom or a substituent, in which R^{11} and R^{12}, R^{12} and R^{13}, R^{13} and R^{14}, R^{14} and R^{15}, R^{15} and R^{16}, R^{15} and R^{16}, R^{17} and R^{18}, R^{18} and R^{19}, and R^{19} and R^{20} each may be bonded to each other to form a cyclic structure; and L^{12} represents a substituted or unsubstituted arylene group or a substituted or unsubstituted heteroarylene group.

[0102] (2) The compound according to the item (1), wherein the group represented by the general formula (132) is a group represented by any one of the following general formulae (133) to (138):

General Formula (133)

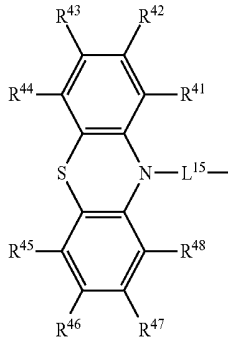


General Formula (134)

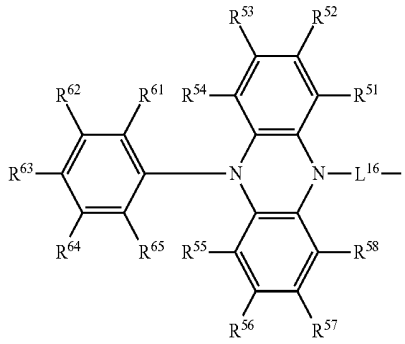


-continued

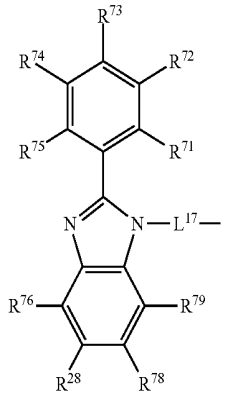
General Formula (135)



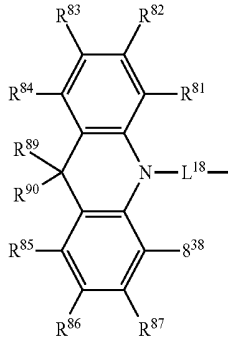
General Formula (136)



General Formula (137)



General Formula (138)



wherein in the general formulae (133) to (138), R^{21} to R^{24}, R^{27} to R^{38}, R^{41} to R^{48}, R^{51} to R^{58}, R^{61} to R^{65}, R^{71} to R^{79}, R^{81} to R^{90} each independently represent a hydrogen atom or a substituent, in which R^{21} and R^{22}, R^{22} and R^{23}, R^{23} and R^{24}, R^{27} and R^{28}, R^{28} and R^{29}, R^{29} and R^{30}, R^{31} and R^{32}, R^{32} and R^{33}, R^{33} and R^{34}, R^{35} and R^{36}, R^{36} and R^{37}, R^{37} and R^{38}, R^{41} and R^{43}, R^{42} and R^{43}, R^{43} and R^{44}, R^{45} and R^{46}, R^{46} and R^{47}, R^{47} and R^{48}, R^{51} and R^{52}, R^{52} and R^{53}, R^{53} and R^{54}, R^{55} and R^{56}, R^{56} and R^{57}, R^{57} and R^{58}, R^{61} and R^{62}, R^{62} and R^{63}, R^{63} and R^{64}, R^{64} and R^{65}, R^{54} and R^{61}, R^{35} and R^{65}, R^{71} and R^{73}, R^{72} and R^{73}, R^{73} and R^{74}, R^{74} and R^{75}, R^{76} and R^{77}, R^{77} and R^{78}, R^{78} and R^{79}, R^{81} and R^{82}, R^{82} and R^{83}, R^{83} and R^{84}, R^{85} and R^{86}, R^{86} and R^{87}, R^{87} and R^{88}, and R^{89} and R^{90} each may be bonded to each other to form a cyclic structure; and L^{13} to L^{18} each independently represent a substituted or unsubstituted arylene group or a substituted or unsubstituted heteroarylene group.

[0103] (3) The compound according to the item (1) or (2), wherein in the general formula (131), R^3 represents a cyano group.

[0104] (4) The compound according to any one of the items (1) to (3), wherein in the general formula (131), R^1 and R^4 each represent a group represented by the general formula (132).

[0105] (5) The compound according to any one of the items (1) to (4), wherein in the general formula (132), L^{12} represents a phenylene group.

[0106] (6) The compound according to any one of the items (1) to (5), wherein the group represented by the general formula (132) is a group represented by the general formula (133).

[0107] (7) The compound according to the item (6), wherein in the general formula (333), L^{13} represents a 1,3-phenylene group.

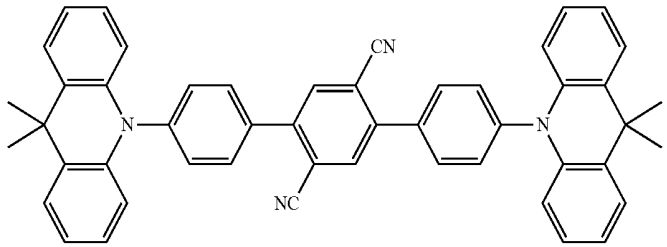
[0108] (8) The compound according to any one of the items (1) to (5), wherein the group represented by the general formula (132) is a group represented by the general formula (134).

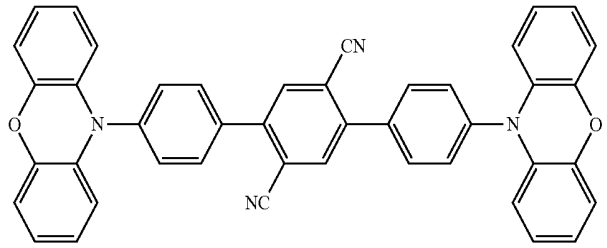
[0109] (9) The compound according to the item (8), wherein in the general formula (134), L^{14} represents a 1,4-phenylene group.

[0110] (10) The compound according to any one of the items (1) to (5), wherein the group represented by the general formula (132) is a group represented by the general formula (139).

[0111] (11) The compound according to the item (10), wherein in the general formula (138), L^{18} represents a 1,4-phenylene group.

[0112] Examples of the compound include the following compounds.


CN
N
N
NC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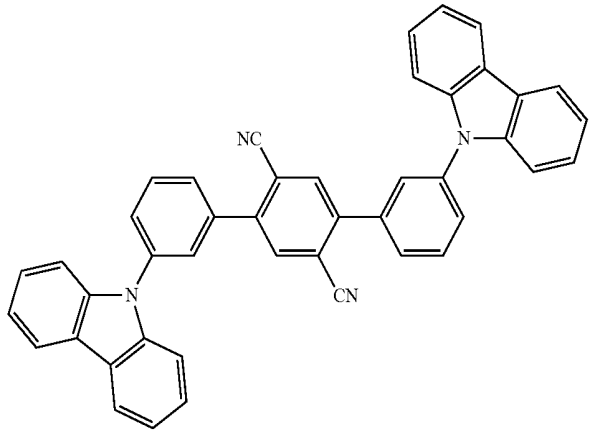
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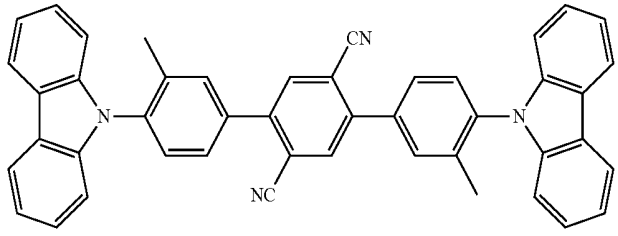
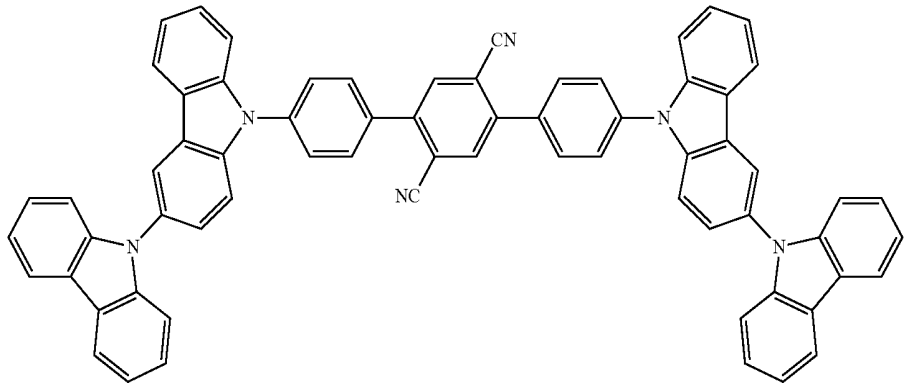

CN
N
N
NC


CN
N
N
NC
N
N

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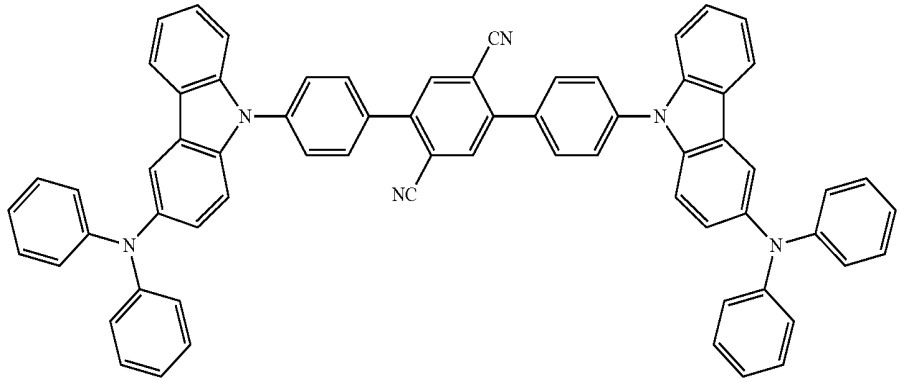

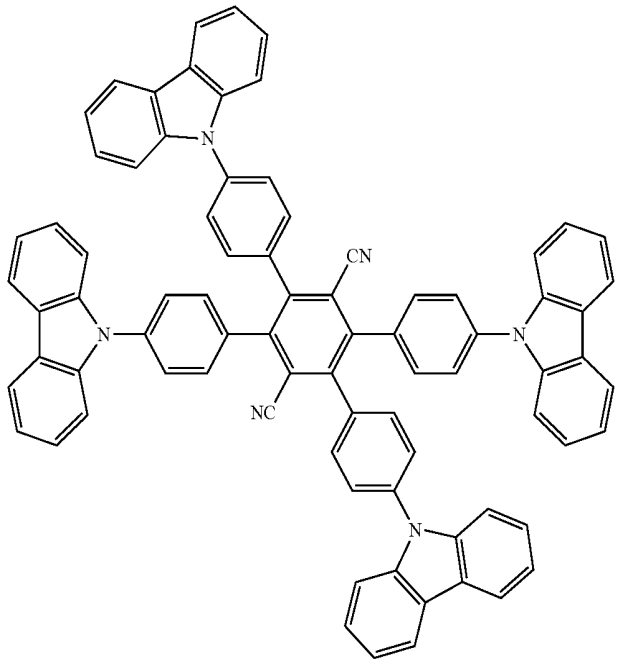

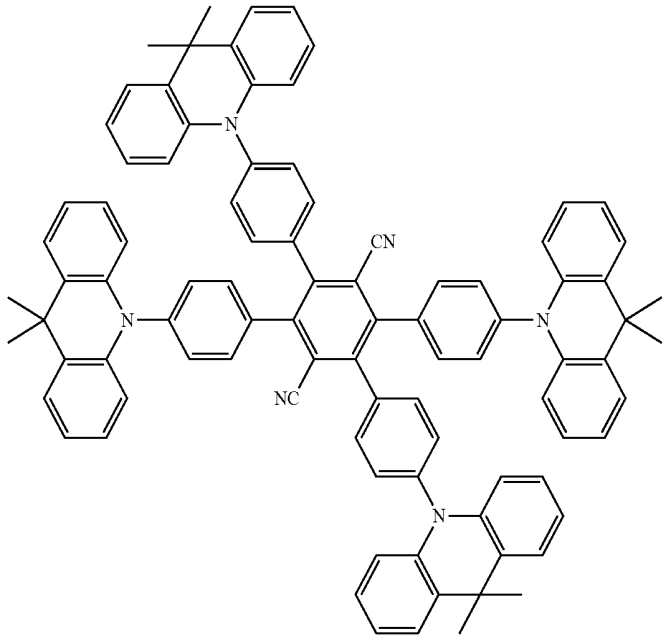

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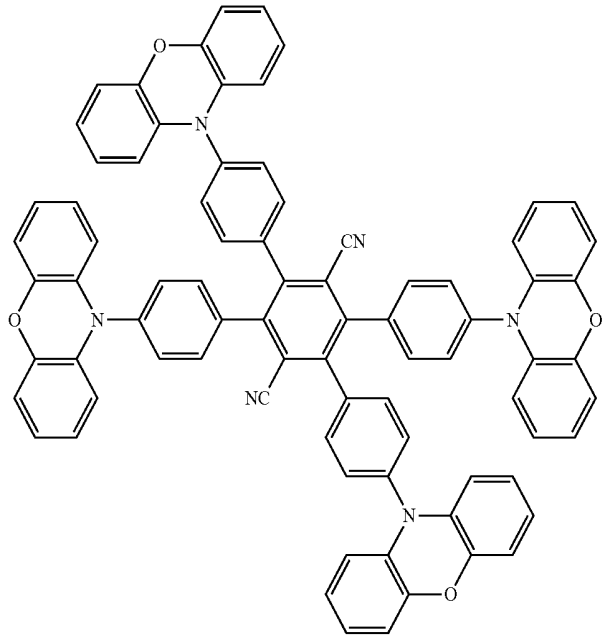

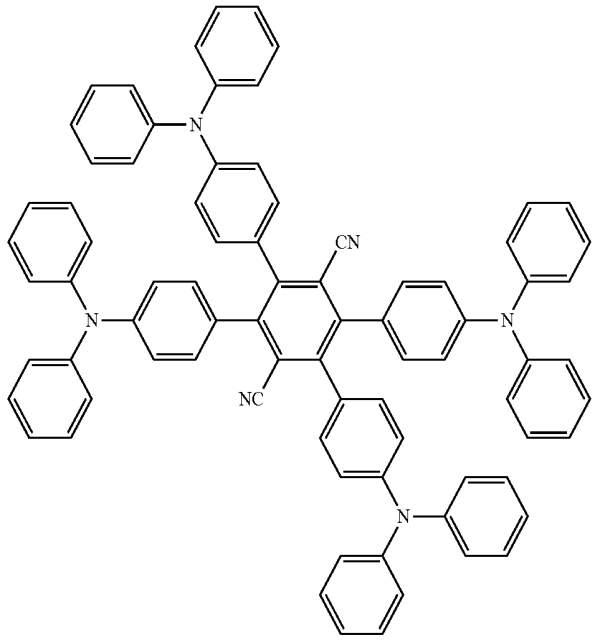

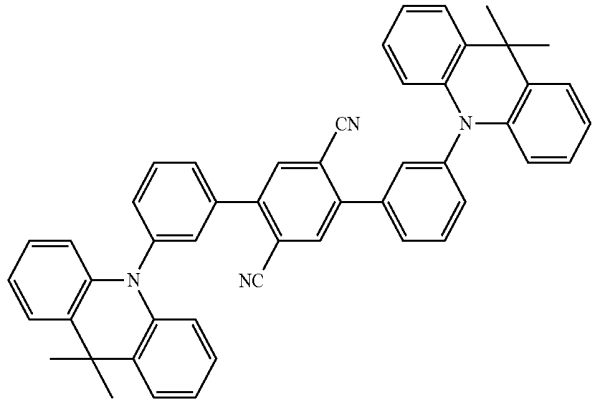

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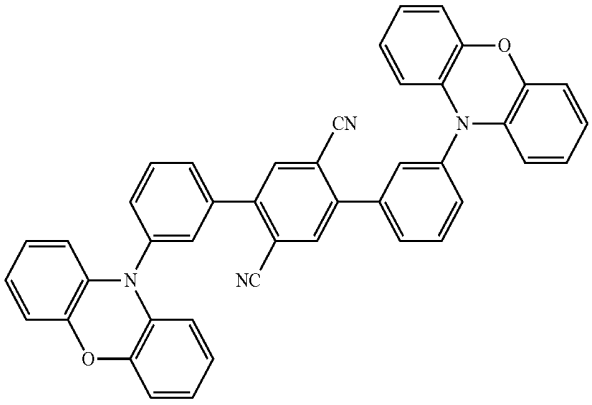

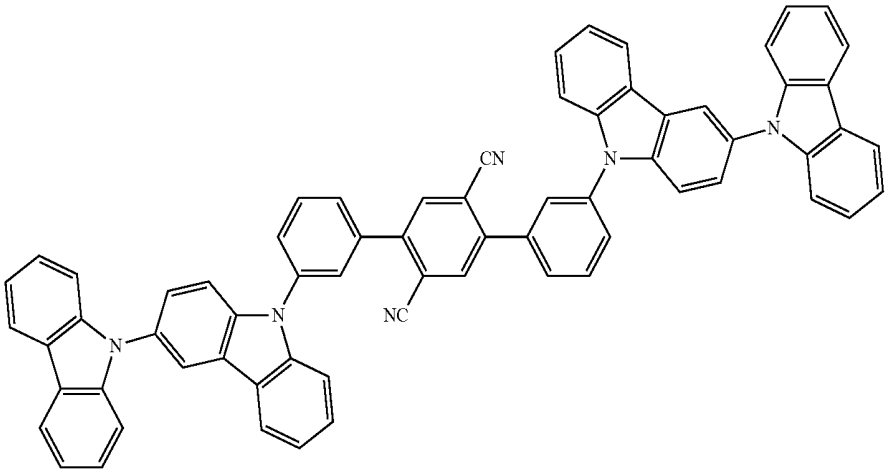

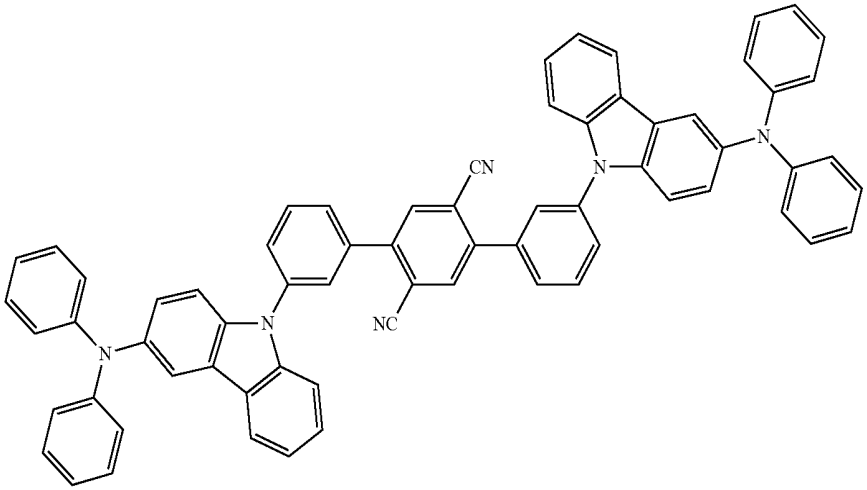

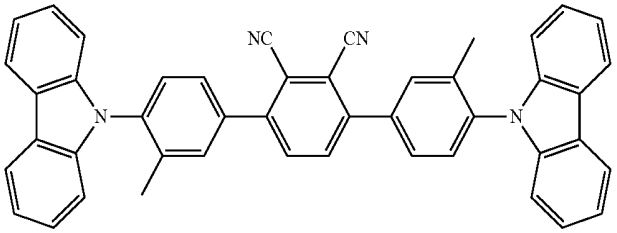

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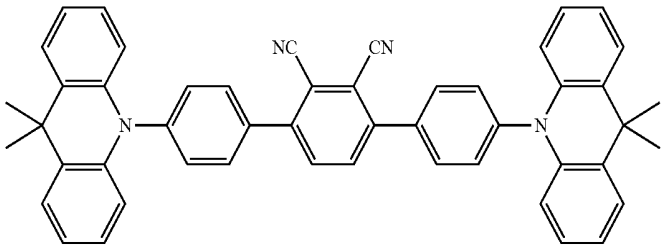

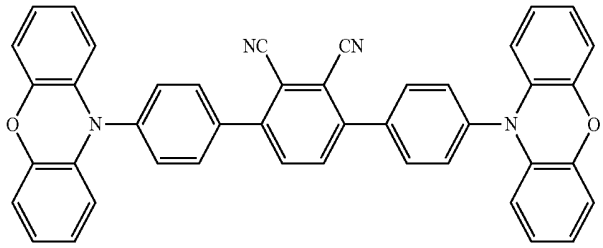

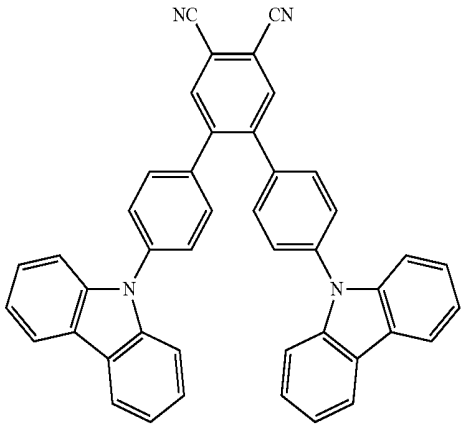

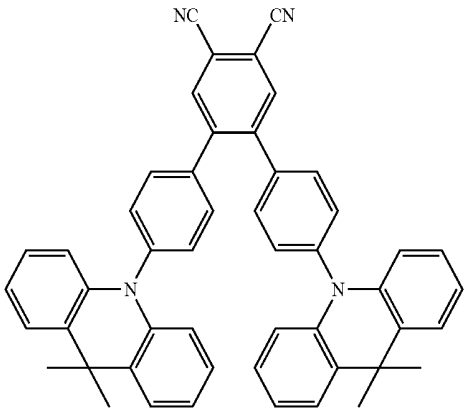

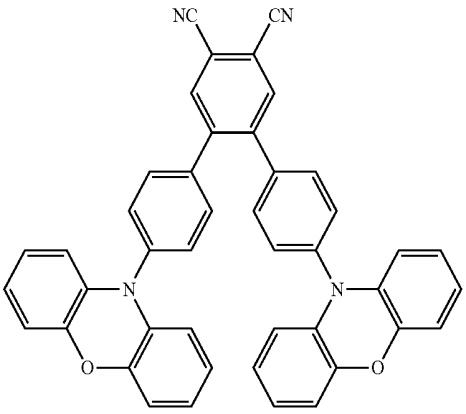

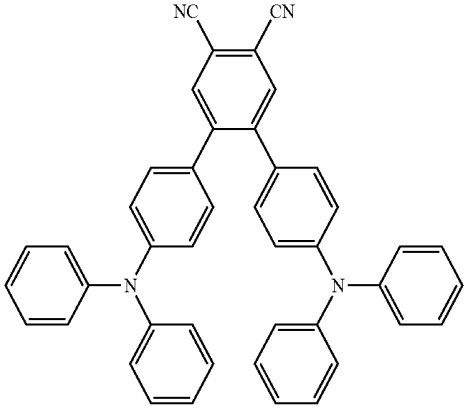

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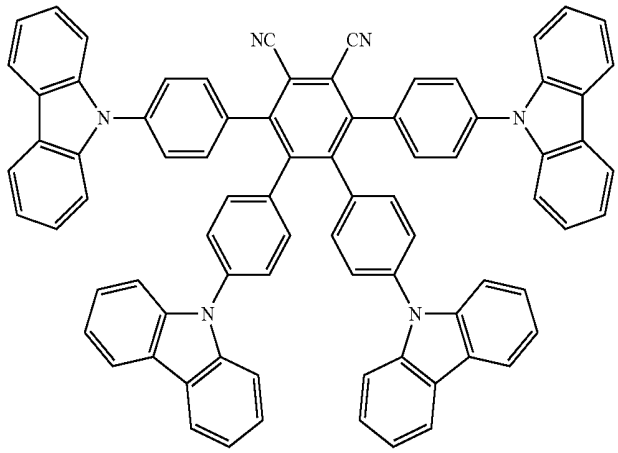

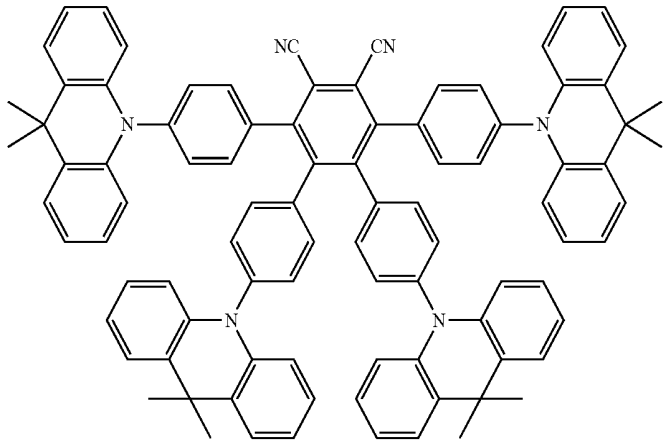

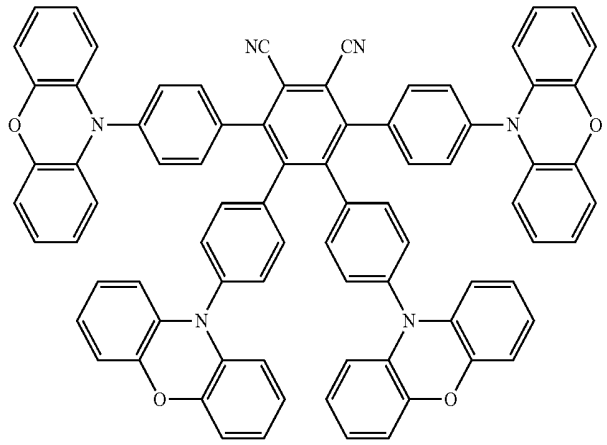

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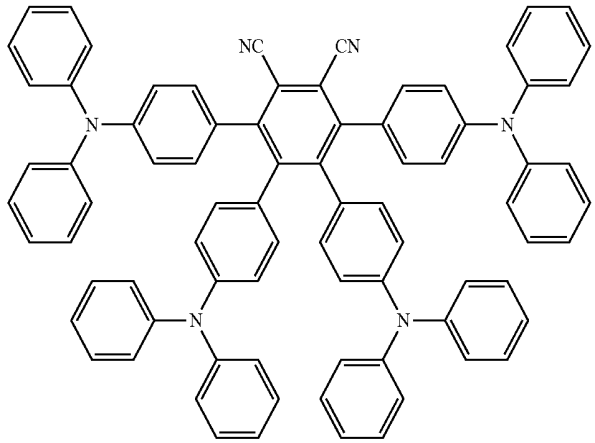

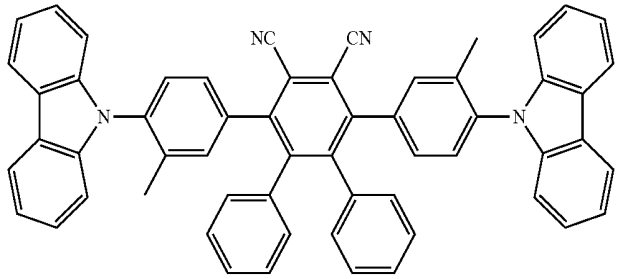

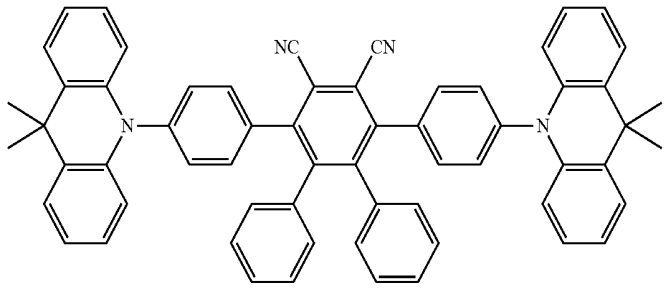

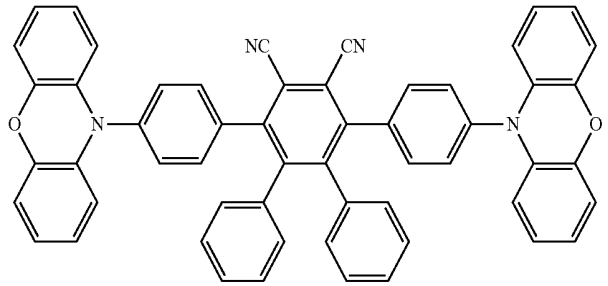

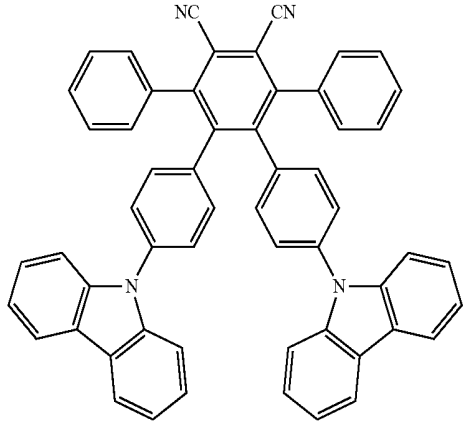

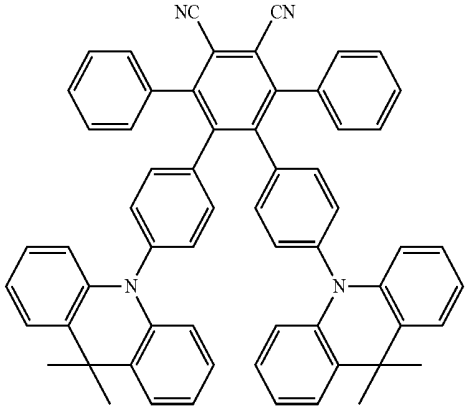

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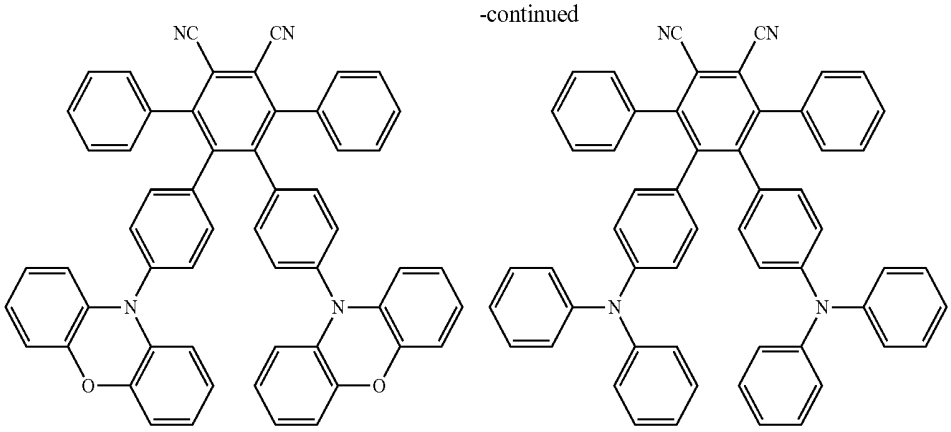
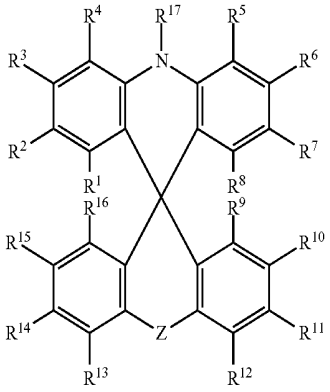


[0113] Examples of the preferred light-emitting material include compounds represented by the following general formula (141). The entire description of WO 2013/011954 including the paragraphs 0007 to 0047 and 0073 to 0085 is incorporated herein by reference.

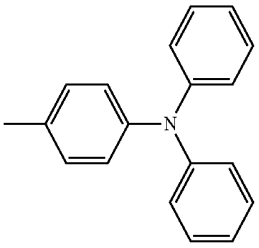
Genenal Formula (141)



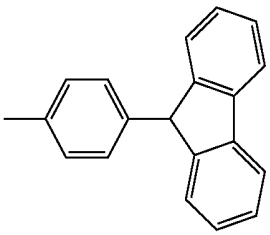
wherein it the general formula (141), R^1, R^2, R^3, R^4, R^5, R^6, R^7, R^8 and R^{17} each independently represent a hydrogen atom or an electron donating group, provided that at least one thereof represents an electron donating group; R^9, R^{10}, R^{11}, R^{12}, R^{13}, R^{14}, R^{15} and R^{16} each independently represent a hydrogen atom or an electron withdrawing group having no unshared electron pair at the α-position; and Z represents a single bond or >C═Y, wherein Y represents O, S, $C(CN)_2$ or $C(COOH)_2$, provided that when Z represents a single bond, at least one of R^9, R^{10}, R^{11}, R^{12}, R^{13}, R^{14}, R^{15} and R^{16} represents an electron withdrawing group having no unshared electron pair at the α-position.

[0114] Specific examples of the compounds include the compounds shown in the following tables. In the tables, D1 to D3 represent the following aryl groups substituted with an electron donating group, respectively; A1 to A5 represent the following electron withdrawing groups, respectively; H represents a hydrogen atom; and Ph represents a phenyl group.

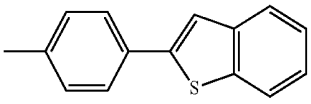
D1



D2

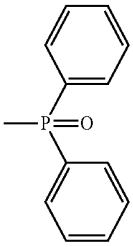


D3

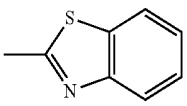


A1

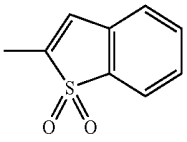
A2



A3



A4



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A5

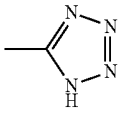


TABLE 7

Compound No.	R^2	R^7	R^{10}	R^{15}	R^{17}	Z	Other Rs
2001	H	H	A1	A1	Ph	single bond	H
2002	H	D1	A1	A1	Ph	single bond	H
2003	H	D2	A1	A1	Ph	single bond	H
2004	H	D3	A1	A1	Ph	single bond	H
2005	H	H	A2	A2	Ph	single bond	H
2006	H	D1	A2	A2	Ph	single bond	H
2007	H	D2	A2	A2	Ph	single bond	H
2008	H	D3	A2	A2	Ph	single bond	H
2009	H	H	A3	A3	Ph	single bond	H
2010	H	D1	A3	A3	Ph	single bond	H
2011	H	D2	A3	A3	Ph	single bond	H
2012	H	D3	A3	A3	Ph	single bond	H
2013	H	H	A4	A4	Ph	single bond	H
2014	H	D1	A4	A4	Ph	single bond	H
2015	H	D2	A4	A4	Ph	single bond	H
2016	H	D3	A4	A4	Ph	single bond	H
2017	H	H	A5	A5	Ph	single bond	H
2018	H	D1	A5	A5	Ph	single bond	H
2019	H	D2	A5	A5	Ph	single bond	H
2020	H	D3	A5	A5	Ph	single bond	H
2021	D1	D1	A1	A1	Ph	single bond	H
2022	D2	D2	A1	A1	Ph	single bond	H
2023	D3	D3	A1	A1	Ph	single bond	H
2024	D1	D1	A2	A2	Ph	single bond	H
2025	D2	D2	A2	A2	Ph	single bond	H
2026	D3	D3	A2	A2	Ph	single bond	H
2027	D1	D1	A3	A3	Ph	single bond	H
2028	D2	D2	A3	A3	Ph	single bond	H
2029	D3	D3	A3	A3	Ph	single bond	H
2030	D1	D1	A4	A4	Ph	single bond	H
2031	D2	D2	A4	A4	Ph	single bond	H
2032	D3	D3	A4	A4	Ph	single bond	H
3033	D1	D1	A5	A5	Ph	single bond	H
2034	D2	D2	A5	A5	Ph	single bond	H
2035	D3	D3	A5	A5	Ph	single bond	H

TABLE 8

Compound No.	R^3	R^6	R^{11}	R^{14}	R^{17}	Z	Other Rs
2036	H	H	H	A1	Ph	single bond	H
2037	H	D1	H	A1	Ph	single bond	H
2038	H	D2	H	A1	Ph	single bond	H
2039	H	D3	H	A1	Ph	single bond	H
2040	H	H	H	A2	Ph	single bond	H
2041	H	D1	H	A2	Ph	single bond	H
2042	H	D2	H	A2	Ph	single bond	H
2043	H	D3	H	A2	Ph	single bond	H
2044	H	H	H	A3	Ph	single bond	H
2045	H	D1	H	A3	Ph	single bond	H
2046	H	D2	H	A3	Ph	single bond	H
2047	H	D3	H	A3	Ph	single bond	H
2048	H	H	H	A4	Ph	single bond	H
2049	H	D1	H	A4	Ph	single bond	H
2050	H	D2	H	A4	Ph	single bond	H
2051	H	D3	H	A4	Ph	single bond	H
2052	H	H	H	A5	Ph	single bond	H
2053	H	D1	H	A5	Ph	single bond	H
2054	H	D2	H	A5	Ph	single bond	H
2055	H	D3	H	A5	Ph	single bond	H
2056	D1	D1	H	A1	Ph	single bond	H
2057	D2	D2	H	A1	Ph	single bond	H

TABLE 8-continued

Compound No.	R^3	R^6	R^{11}	R^{14}	R^{17}	Z	Other Rs
2058	D3	D3	H	A1	Ph	single bond	H
2059	D1	D1	H	A2	Ph	single bond	H
2060	D2	D2	H	A2	Ph	single bond	H
2061	D3	D3	H	A2	Ph	single bond	H
2062	D1	D1	H	A3	Ph	single bond	H
2063	D2	D2	H	A3	Ph	single bond	H
2064	D3	D3	H	A3	Ph	single bond	H
2065	D1	D1	H	A4	Ph	single bond	H
2066	D2	D2	H	A4	Ph	single bond	H
2067	D3	D3	H	A4	Ph	single bond	H
2068	D1	D1	H	A5	Ph	single bond	H
2069	D2	D2	H	A5	Ph	single bond	H
2070	D3	D3	H	A5	Ph	single bond	H

TABLE 9

Compound No.	R^2	R^7	R^{10}	R^{15}	R^{17}	Z	Other Rs
2071	H	H	A1	A1	Ph	C═O	H
2072	H	D1	A1	A1	Ph	C═O	H
2073	H	D2	A1	A1	Ph	C═O	H
2074	H	D3	A1	A1	Ph	C═O	H
2075	H	H	A2	A2	Ph	C═O	H
2076	H	D1	A2	A2	Ph	C═O	H
2077	H	D2	A2	A2	Ph	C═O	H
2078	H	D3	A2	A2	Ph	C═O	H
2079	H	H	A3	A3	Ph	C═O	H
2080	H	D1	A3	A3	Ph	C═O	H
2081	H	D2	A3	A3	Ph	C═O	H
2082	H	D3	A3	A3	Ph	C═O	H
2083	H	H	A4	A4	Ph	C═O	H
2084	H	D1	A4	A4	Ph	C═O	H
2085	H	D2	A4	A4	Ph	C═O	H
2086	H	D3	A4	A4	Ph	C═O	H
2087	H	H	A5	A5	Ph	C═O	H
2088	H	D1	A5	A5	Ph	C═O	H
2089	H	D2	A5	A5	Ph	C═O	H
2090	H	D3	A5	A5	Ph	C═O	H
2091	D1	D1	A1	A1	Ph	C═O	H
2092	D2	D2	A1	A1	Ph	C═O	H
2093	D3	D3	A1	A1	Ph	C═O	H
2094	D1	D1	A2	A2	Ph	C═O	H
2095	D2	D2	A2	A2	Ph	C═O	H
2096	D3	D3	A2	A2	Ph	C═O	H
2097	D1	D1	A3	A3	Ph	C═O	H
2098	D2	D2	A3	A3	Ph	C═O	H
2099	D3	D3	A3	A3	Ph	C═O	H
2100	D1	D1	A4	A4	Ph	C═O	H
2101	D2	D2	A4	A4	Ph	C═O	H
2102	D3	D3	A4	A4	Ph	C═O	H
2103	D1	D1	A5	A5	Ph	C═O	H
2104	D2	D2	A5	A5	Ph	C═O	H
2105	D3	D3	A5	A5	Ph	C═O	H

TABLE 10

Compound No.	R^3	R^6	R^{11}	R^{14}	R^{17}	Z	Other Rs
2106	H	H	H	A1	Ph	C═O	H
2107	H	D1	H	A1	Ph	C═O	H
2108	H	D2	H	A1	Ph	C═O	H
2109	H	D3	H	A1	Ph	C═O	H
2110	H	H	H	A2	Ph	C═O	H
2111	H	D1	H	A2	Ph	C═O	H
2112	H	D2	H	A2	Ph	C═O	H
2113	H	D3	H	A2	Ph	C═O	H
2114	H	H	H	A3	Ph	C═O	H
2115	H	D1	H	A3	Ph	C═O	H
2116	H	D2	H	A3	Ph	C═O	H
2117	H	D3	H	A3	Ph	C═O	H

TABLE 10-continued

Compound No.	R^3	R^6	R^{11}	R^{14}	R^{17}	Z	Other Rs
2118	H	H	H	A4	Ph	C═O	H
2119	H	D1	H	A4	Ph	C═O	H
2120	H	D2	H	A4	Ph	C═O	H
2121	H	D3	H	A4	Ph	C═O	H
2122	H	H	H	A5	Ph	C═O	H
2123	H	D1	H	A5	Ph	C═O	H
2124	H	D2	H	A5	Ph	C═O	H
2125	H	D3	H	A5	Ph	C═O	H
2126	D1	D1	H	A1	Ph	C═O	H
2127	D2	D2	H	A1	Ph	C═O	H
2128	D3	D3	H	A1	Ph	C═O	H
2129	D1	D1	H	A2	Ph	C═O	H
2130	D2	D2	H	A2	Ph	C═O	H
2131	D3	D3	H	A2	Ph	C═O	H
2132	D1	D1	H	A3	Ph	C═O	H
2133	D2	D2	H	A3	Ph	C═O	H
2134	D3	D3	H	A3	Ph	C═O	H
2135	D1	D1	H	A4	Ph	C═O	H
2136	D2	D2	H	A4	Ph	C═O	H
2137	D3	D3	H	A4	Ph	C═O	H
2138	D1	D1	H	A5	Ph	C═O	H
2139	D2	D2	H	A5	Ph	C═O	H
2140	D3	D3	H	A5	Ph	C═O	H
2141	H	H	H	H	Ph	C═O	H

TABLE 11

Compound No.	R^2	R^7	R^{10}	R^{15}	R^{17}	Z	Other Rs
2142	H	H	A1	A1	Ph	C═S	H
2143	H	D1	A1	A1	Ph	C═S	H
2144	H	D2	A1	A1	Ph	C═S	H
2145	H	D3	A1	A1	Ph	C═S	H
2146	H	H	A2	A2	Ph	C═S	H
2147	H	D1	A2	A2	Ph	C═S	H
2148	H	D2	A2	A2	Ph	C═S	H
2149	H	D3	A2	A2	Ph	C═S	H
2150	H	H	A3	A3	Ph	C═S	H
2151	H	D1	A3	A3	Ph	C═S	H
2152	H	D2	A3	A3	Ph	C═S	H
2153	H	D3	A3	A3	Ph	C═S	H
2154	H	H	A4	A4	Ph	C═S	H
2155	H	D1	A4	A4	Ph	C═S	H
2156	H	D2	A4	A4	Ph	C═S	H
2157	H	D3	A4	A4	Ph	C═S	H
2158	H	H	A5	A5	Ph	C═S	H
2159	H	D1	A5	A5	Ph	C═S	H
2160	H	D2	A5	A5	Ph	C═S	H
2161	H	D3	A5	A5	Ph	C═S	H
2162	D1	D1	A1	A1	Ph	C═S	H
2163	D2	D2	A1	A1	Ph	C═S	H
2164	D3	D3	A1	A1	Ph	C═S	H
2165	D1	D1	A2	A2	Ph	C═S	H
2166	D2	D2	A2	A2	Ph	C═S	H
2167	D3	D3	A2	A2	Ph	C═S	H
2168	D1	D1	A3	A3	Ph	C═S	H
2169	D2	D2	A3	A3	Ph	C═S	H
2170	D3	D3	A3	A3	Ph	C═S	H
2171	D1	D1	A4	A4	Ph	C═S	H
2172	D2	D2	A4	A4	Ph	C═S	H
2173	D3	D3	A4	A4	Ph	C═S	H
2174	D1	D1	A5	A5	Ph	C═S	H
2175	D2	D2	A5	A5	Ph	C═S	H
2176	D3	D3	A5	A5	Ph	C═S	H

TABLE 12

Compound No.	R^3	R^6	R^{11}	R^{14}	R^{17}	Z	Other Rs
2177	H	H	H	A1	Ph	C═S	H
2178	H	D1	H	A1	Ph	C═S	H

TABLE 12-continued

Compound No.	R^3	R^6	R^{11}	R^{14}	R^{17}	Z	Other Rs
2179	H	D2	H	A1	Ph	C═S	H
2180	H	D3	H	A1	Ph	C═S	H
2181	H	H	H	A2	Ph	C═S	H
2182	H	D1	H	A2	Ph	C═S	H
2183	H	D2	H	A2	Ph	C═S	H
2184	H	D3	H	A2	Ph	C═S	H
2185	H	H	H	A3	Ph	C═S	H
2186	H	D1	H	A3	Ph	C═S	H
2187	H	D2	H	A3	Ph	C═S	H
2188	H	D3	H	A3	Ph	C═S	H
2189	H	H	H	A4	Ph	C═S	H
2190	H	D1	H	A4	Ph	C═S	H
2191	H	D2	H	A4	Ph	C═S	H
2192	H	D3	H	A4	Ph	C═S	H
2193	H	H	H	A5	Ph	C═S	H
2194	H	D1	H	A5	Ph	C═S	H
2195	H	D2	H	A5	Ph	C═S	H
2196	H	D3	H	A5	Ph	C═S	H
2197	D1	D1	H	A1	Ph	C═S	H
2198	D2	D2	H	A1	Ph	C═S	H
2199	D3	D3	H	A1	Ph	C═S	H
2200	D1	D1	H	A2	Ph	C═S	H
2201	D2	D2	H	A2	Ph	C═S	H
2202	D3	D3	H	A2	Ph	C═S	H
2203	D1	D1	H	A3	Ph	C═S	H
2204	D2	D2	H	A3	Ph	C═S	H
2205	D3	D3	H	A3	Ph	C═S	H
2206	D1	D1	H	A4	Ph	C═S	H
2207	D2	D2	H	A4	Ph	C═S	H
2208	D3	D3	H	A4	Ph	C═S	H
2209	D1	D1	H	A5	Ph	C═S	H
2210	D2	D2	H	A5	Ph	C═S	H
2211	D3	D3	H	A5	Ph	C═S	H
2212	H	H	H	H	Ph	C═S	H

TABLE 13

Compound No.	R^2	R^7	R^{10}	R^{15}	R^{17}	Z	Other Rs
2213	H	H	A1	A1	Ph	$C{=}C(CN)_2$	H
2214	H	D1	A1	A1	Ph	$C{=}C(CN)_2$	H
2215	H	D2	A1	A1	Ph	$C{=}C(CN)_2$	H
2216	H	D3	A1	A1	Ph	$C{=}C(CN)_2$	H
2217	H	H	A2	A2	Ph	$C{=}C(CN)_2$	H
2218	H	D1	A2	A2	Ph	$C{=}C(CN)_2$	H
2219	H	D2	A2	A2	Ph	$C{=}C(CN)_2$	H
2220	H	D3	A2	A2	Ph	$C{=}C(CN)_2$	H
2221	H	H	A3	A3	Ph	$C{=}C(CN)_2$	H
2222	H	D1	A3	A3	Ph	$C{=}C(CN)_2$	H
2223	H	D2	A3	A3	Ph	$C{=}C(CN)_2$	H
2224	H	D3	A3	A3	Ph	$C{=}C(CN)_2$	H
2225	H	H	A4	A4	Ph	$C{=}C(CN)_2$	H
2226	H	D1	A4	A4	Ph	$C{=}C(CN)_2$	H
2227	H	D2	A4	A4	Ph	$C{=}C(CN)_2$	H
2228	H	D3	A4	A4	Ph	$C{=}C(CN)_2$	H
2229	H	H	A5	A5	Ph	$C{=}C(CN)_2$	H
2230	H	D1	A5	A5	Ph	$C{=}C(CN)_2$	H
2231	H	D2	A5	A5	Ph	$C{=}C(CN)_2$	H
2232	H	D3	A5	A5	Ph	$C{=}C(CN)_2$	H
2233	D1	D1	A1	A1	Ph	$C{=}C(CN)_2$	H
2234	D2	D2	A1	A1	Ph	$C{=}C(CN)_2$	H
2235	D3	D3	A1	A1	Ph	$C{=}C(CN)_2$	H
2236	D1	D1	A2	A2	Ph	$C{=}C(CN)_2$	H
2237	D2	D2	A2	A2	Ph	$C{=}C(CN)_2$	H
2238	D3	D3	A2	A2	Ph	$C{=}C(CN)_2$	H
2239	D1	D1	A3	A3	Ph	$C{=}C(CN)_2$	H
2240	D2	D2	A3	A3	Ph	$C{=}C(CN)_2$	H
2241	D3	D3	A3	A3	Ph	$C{=}C(CN)_2$	H
2242	D1	D1	A4	A4	Ph	$C{=}C(CN)_2$	H
2243	D2	D2	A4	A4	Ph	$C{=}C(CN)_2$	H
2244	D3	D3	A4	A4	Ph	$C{=}C(CN)_2$	H

TABLE 13-continued

Compound No.	R^2	R^7	R^{10}	R^{15}	R^{17}	Z	Other Rs
2245	D1	D1	A5	A5	Ph	C=C $(CN)_2$	H
2246	D2	D2	A5	A5	Ph	C=C $(CN)_2$	H
2247	D3	D3	A5	A5	Ph	C=C $(CN)_2$	H

TABLE 14

Compound No.	R^3	R^6	R^{11}	R^{14}	R^{17}	Z	Other Rs
2248	H	H	H	A1	Ph	C=C $(CN)_2$	H
2249	H	D1	H	A1	Ph	C=C $(CN)_2$	H
2250	H	D2	H	A1	Ph	C=C $(CN)_2$	H
2251	H	D3	H	A1	Ph	C=C $(CN)_2$	H
2252	H	H	H	A2	Ph	C=C $(CN)_2$	H
2253	H	D1	H	A2	Ph	C=C $(CN)_2$	H
2254	H	D2	H	A2	Ph	C=C $(CN)_2$	H
2255	H	D3	H	A2	Ph	C=C $(CN)_2$	H
2256	H	H	H	A3	Ph	C=C $(CN)_2$	H
2257	H	D1	H	A3	Ph	C=C $(CN)_2$	H
2258	H	D2	H	A3	Ph	C=C $(CN)_2$	H
2259	H	D3	H	A3	Ph	C=C $(CN)_2$	H
2260	H	H	H	A4	Ph	C=C $(CN)_2$	H
2261	H	D1	H	A4	Ph	C=C $(CN)_2$	H
2262	H	D2	H	A4	Ph	C=C $(CN)_2$	H
2263	H	D3	H	A4	Ph	C=C $(CN)_2$	H
2264	H	H	H	A5	Ph	C=C $(CN)_2$	H
2265	H	D1	H	A5	Ph	C=C $(CN)_2$	H
2266	H	D2	H	A5	Ph	C=C $(CN)_2$	H
2267	H	D3	H	A5	Ph	C=C $(CN)_2$	H
2268	D1	D1	H	A1	Ph	C=C $(CN)_2$	H
2269	D2	D2	H	A1	Ph	C=C $(CN)_2$	H
2270	D3	D3	H	A1	Ph	C=C $(CN)_2$	H
2271	D1	D1	H	A2	Ph	C=C $(CN)_2$	H
2272	D2	D2	H	A2	Ph	C=C $(CN)_2$	H
2273	D3	D3	H	A2	Ph	C=C $(CN)_2$	H
2274	D1	D1	H	A3	Ph	C=C $(CN)_2$	H
2275	D2	D2	H	A3	Ph	C=C $(CN)_2$	H
2276	D3	D3	H	A3	Ph	C=C $(CN)_2$	H
2277	D1	D1	H	A4	Ph	C=C $(CN)_2$	H
2278	D2	D2	H	A4	Ph	C=C $(CN)_2$	H
2279	D3	D3	H	A4	Ph	C=C $(CN)_2$	H
2280	D1	D1	H	A5	Ph	C=C $(CN)_2$	H
2281	D2	D2	H	A5	Ph	C=C $(CN)_2$	H
2282	D3	D3	H	A5	Ph	C=C $(CN)_2$	H
2283	H	H	H	H	Ph	C=C $(CN)_2$	H

TABLE 15

Compound No.	R^2	R^7	R^{10}	R^{15}	R^{17}	Z	Other Rs
2284	H	H	A1	A1	Ph	C=C $(COOH)_2$	H
2285	H	D1	A1	A1	Ph	C=C $(COOH)_2$	H
2286	H	D2	A1	A1	Ph	C=C $(COOH)_2$	H
2287	H	D3	A1	A1	Ph	C=C $(COOH)_2$	H
2288	H	H	A2	A2	Ph	C=C $(COOH)_2$	H
2289	H	D1	A2	A2	Ph	C=C $(COOH)_2$	H
2290	H	D2	A2	A2	Ph	C=C $(COOH)_2$	H
2291	H	D3	A2	A2	Ph	C=C $(COOH)_2$	H
2292	H	H	A3	A3	Ph	C=C $(COOH)_2$	H
2293	H	D1	A3	A3	Ph	C=C $(COOH)_2$	H
2294	H	D2	A3	A3	Ph	C=C $(COOH)_2$	H
2295	H	D3	A3	A3	Ph	C=C $(COOH)_2$	H
2296	H	H	A4	A4	Ph	C=C $(COOH)_2$	H
2297	H	D1	A4	A4	Ph	C=C $(COOH)_2$	H
2298	H	D2	A4	A4	Ph	C=C $(COOH)_2$	H
2299	H	D3	A4	A4	Ph	C=C $(COOH)_2$	H
2300	H	H	A5	A5	Ph	C=C $(COOH)_2$	H
2301	H	D1	A5	A5	Ph	C=C $(COOH)_2$	H
2302	H	D2	A5	A5	Ph	C=C $(COOH)_2$	H
2303	H	D3	A5	A5	Ph	C=C $(COOH)_2$	H
2304	D1	D1	A1	A1	Ph	C=C $(COOH)_2$	H

TABLE 15-continued

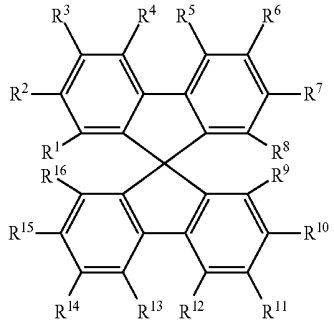
Compound No.	R^2	R^7	R^{10}	R^{15}	R^{17}	Z	Other Rs
2305	D2	D2	A1	A1	Ph	C=C $(COOH)_2$	H
2306	D3	D3	A1	A1	Ph	C=C $(COOH)_2$	H
2307	D1	D1	A2	A2	Ph	C=C $(COOH)_2$	H
2308	D2	D2	A2	A2	Ph	C=C $(COOH)_2$	H
2309	D3	D3	A2	A2	Ph	C=C $(COOH)_2$	H
2310	D1	D1	A3	A3	Ph	C=C $(COOH)_2$	H
2311	D2	D2	A3	A3	Ph	C=C $(COOH)_2$	H
2312	D3	D3	A3	A3	Ph	C=C $(COOH)_2$	H
2313	D1	D1	A4	A4	Ph	C=C $(COOH)_2$	H
2314	D2	D2	A4	A4	Ph	C=C $(COOH)_2$	H
2315	D3	D3	A4	A4	Ph	C=C $(COOH)_2$	H
2316	D1	D1	A5	A5	Ph	C=C $(COOH)_2$	H
2317	D2	D2	A5	A5	Ph	C=C $(COOH)_2$	H
2318	D3	D3	A5	A5	Ph	C=C $(COOH)_2$	H

TABLE 16

Compound No.	R^3	R^6	R^{11}	R^{14}	R^{17}	Z	Other Rs
2319	H	H	H	A1	Ph	C=C $(COOH)_2$	H
2320	H	D1	H	A1	Ph	C=C $(COOH)_2$	H
2321	H	D2	H	A1	Ph	C=C $(COOH)_2$	H
2322	H	D3	H	A1	Ph	C=C $(COOH)_2$	H
2323	H	H	H	A2	Ph	C=C $(COOH)_2$	H
2324	H	D1	H	A2	Ph	C=C $(COOH)_2$	H
2325	H	D2	H	A2	Ph	C=C $(COOH)_2$	H
2326	H	D3	H	A2	Ph	C=C $(COOH)_2$	H
2327	H	H	H	A3	Ph	C=C $(COOH)_2$	H
2328	H	D1	H	A3	Ph	C=C $(COOH)_2$	H
2329	H	D2	H	A3	Ph	C=C $(COOH)_2$	H
2330	H	D3	H	A3	Ph	C=C $(COOH)_2$	H
2331	H	H	H	A4	Ph	C=C $(COOH)_2$	H
2332	H	D1	H	A4	Ph	C=C $(COOH)_2$	H
2333	H	D2	H	A4	Ph	C=C $(COOH)_2$	H
2334	H	D3	H	A4	Ph	C=C $(COOH)_2$	H
2335	H	H	H	A5	Ph	C=C $(COOH)_2$	H
2336	H	D1	H	A5	Ph	C=C $(COOH)_2$	H
2337	H	D2	H	A5	Ph	C=C $(COOH)_2$	H
2338	H	D3	H	A5	Ph	C=C $(COOH)_2$	H
2339	D1	D1	H	A1	Ph	C=C $(COOH)_2$	H
2340	D2	D2	H	A1	Ph	C=C $(COOH)_2$	H
2341	D3	D3	H	A1	Ph	C=C $(COOH)_2$	H
2342	D1	D1	H	A2	Ph	C=C $(COOH)_2$	H
2343	D2	D2	H	A2	Ph	C=C $(COOH)_2$	H
2344	D3	D3	H	A2	Ph	C=C $(COOH)_2$	H
2345	D1	D1	H	A3	Ph	C=C $(COOH)_2$	H
2346	D2	D2	H	A3	Ph	C=C $(COOH)_2$	H
2347	D3	D3	H	A3	Ph	C=C $(COOH)_2$	H
2348	D1	D1	H	A4	Ph	C=C $(COOH)_2$	H
2349	D2	D2	H	A4	Ph	C=C $(COOH)_2$	H
2350	D3	D3	H	A4	Ph	C=C $(COOH)_2$	H
2351	D1	D1	H	A5	Ph	C=C $(COOH)_2$	H
2352	D2	D2	H	A5	Ph	C=C $(COOH)_2$	H
2353	D3	D3	H	A5	Ph	C=C $(COOH)_2$	H
2354	H	H	H	H	Ph	C=C $(COOH)_2$	H

[0115] Examples of the preferred light-emitting material include compounds represented by the following general formula (151). The entire description of WO 2013/011955 including the paragraphs 0007 to 0033 and 0059 to 0066 is incorporated herein by reference.

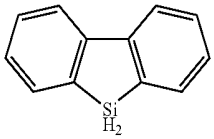
General Formula (151)



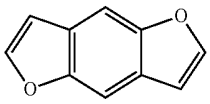
wherein in the general formula (151), R^1, R^2, R^3, R^4, R^5, R^6, R^7 and R^8 each independently represent a hydrogen atom or an electron donating group, provided that at least one thereof represents an electron donating group; R^9, R^{10}, R^{11}, R^{12}, R^{13}, R^{14}, R^{15} and R^{16} each independently represent a hydrogen atom or an electron withdrawing group, provided that at least one thereof represents an electron withdrawing group.

[0116] Specific examples of the compounds include the compounds shown in the following tables. In the tables, D1 to D10 represent the unsubstituted electron donating groups having the following structures, respectively.

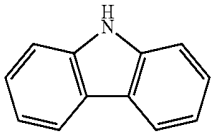
D1



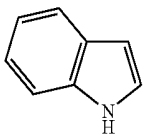
D2



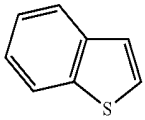
D3



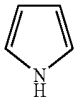
D4



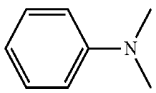
D5



D6



D7



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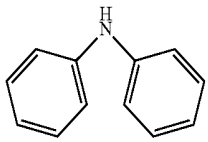
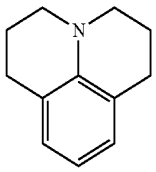
D8



D9



D10

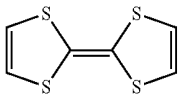
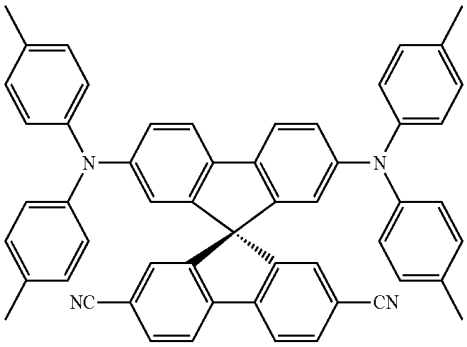


TABLE 17



Compound 3001

Compound No.	R^2	R^7	R^{10}	R^{15}	Other Rs
3002	D1	D1	CN	CN	H
3003	D2	D2	CN	CN	H
3004	D3	D3	CN	CN	H
3005	D4	D4	CN	CN	H
3006	D5	D5	CN	CN	H
3007	D6	D6	CN	CN	H
3008	D7	D7	CN	CN	H
3009	D8	D8	CN	CN	H
3010	D9	D9	CN	CN	H
3011	D10	D10	CN	CN	H
3012	H	D1	H	CN	H
3013	H	D2	H	CN	H
3014	H	D3	H	CN	H
3015	H	D4	H	CN	H
3016	H	D5	H	CN	H
3017	H	D6	H	CN	H
3018	H	D7	H	CN	H
3019	H	D8	H	CN	H
3020	H	D9	H	CN	H
3021	H	D10	H	CN	H

TABLE 18

Compound No.	R^3	R^6	R^{11}	R^{14}	Other Rs
3022	D1	D1	CN	CN	H
3023	D2	D2	CN	CN	H

TABLE 18-continued

Compound No.	R^3	R^6	R^{11}	R^{14}	Other Rs
3024	D3	D3	CN	CN	H
3025	D4	D4	CN	CN	H
3026	D5	D5	CN	CN	H
3027	D6	D6	CN	CN	H
3028	D7	D7	CN	CN	H
3029	D8	D8	CN	CN	H
3030	D9	D9	CN	CN	H
3031	D10	D10	CN	CN	H
3032	H	D1	H	CN	H
3033	H	D2	H	CN	H

TABLE 18-continued

Compound No.	R^3	R^6	R^{11}	R^{14}	Other Rs
3034	H	D3	H	CN	H
3035	H	D4	H	CN	H
3036	H	D5	H	CN	H
3037	H	D6	H	CN	H
3038	H	D7	H	CN	H
3039	H	D8	H	CN	H
3040	H	D9	H	CN	H
3041	H	D10	H	CN	H

TABLE 19

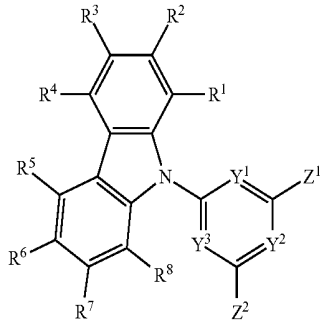
Compound No.	R^2, R^7	R^3, R^6	R^{10}, R^{15}	R^{11}, R^{14}	Other Rs
3042	diphenylamino group	H	CN	H	H
3043	bis (2-methylphenyl) amino group	H	CN	H	H
3044	bis (3-methylphenyl) amino group	H	CN	H	H
3045	bis (2,4-dimethylphenyl) amino group	H	CN	H	H
3046	bis (2,6-dimethylphenyl) amino group	H	CN	H	H
3047	bis (3,5-dimethylphenyl) amino group	H	CN	H	H
3048	bis (2,4,6-trimethylphenyl) amino group	H	CN	H	H
3049	bis (4-ethylphenyl) amino group	H	CN	H	H
3050	bis (4-propylphenyl) amino group	H	CN	H	H
3051	diphenylamino group	H	H	CN	H
3052	bis (2-methylphenyl) amino group	H	H	CN	H
3053	bis (3-methylphenyl) amino group	H	H	CN	H
3054	bis (4-methylphenyl) amino group	H	H	CN	H
3055	bis (2,4-dimethylphenyl) amino group	H	H	CN	H
3056	bis (2,6-dimethylphenyl) amino group	H	H	CN	H
3057	bis (3,5-dimethylphenyl) amino group	H	H	CN	H
3058	bis (2,4,6-trimethylphenyl) amino group	H	H	CN	H
3059	bis (4-ethylphenyl) amino group	H	H	CN	H
3060	bis (4-propylphenyl) amino group	H	H	CN	H

TABLE 20

Compound No.	R^2, R^7	R^3, R^6	R^{10}, R^{15}	R^{11}, R^{14}	Other Rs
3061	H	diphenylamino group	CN	H	H
3062	H	bis (2-methylphenyl) amino group	CN	H	H
3063	H	bis (3-methylphenyl) amino group	CN	H	H
3064	H	bis (4-methylphenyl) amino group	CN	H	H
3065	H	bis (2,4-dimethylphenyl) amino group	CN	H	H
3066	H	bis (2,6-dimethylphenyl) amino group	CN	H	H
3067	H	bis (3,5-dimethylphenyl) amino group	CN	H	H
3068	H	bis (2,4,6-trimethylphenyl) amino group	CN	H	H
3069	H	bis (4-ethylphenyl) amino group	CN	H	H
3070	H	bis (4-propylphenyl) amino group	CN	H	H
3071	H	diphenylamino group	H	CN	H
3072	H	bis (2-methylphenyl) amino group	H	CN	H
3073	H	bis (3-methylphenyl) amino group	H	CN	H
3074	H	bis (4-methylphenyl) amino group	H	CN	H
3075	H	bis (2,4-dimethylphenyl) amino group	H	CN	H
3076	H	bis (2,6-dimethylphenyl) amino group	H	CN	H
3077	H	bis (3,5-dimethylphenyl) amino group	H	CN	H
3078	H	bis (2,4,6-trimethylphenyl) amino group	H	CN	H
3079	H	bis (4-ethylphenyl) amino group	H	CN	H
3080	H	bis (4-propylphenyl) amino group	H	CN	H

[0117] Examples of the preferred light-emitting material include compounds represented by the following general formula (161). The entire description of WO 2013/081088 including the paragraphs 0008 to 0071 and 0118 to 0133 is incorporated herein by reference.

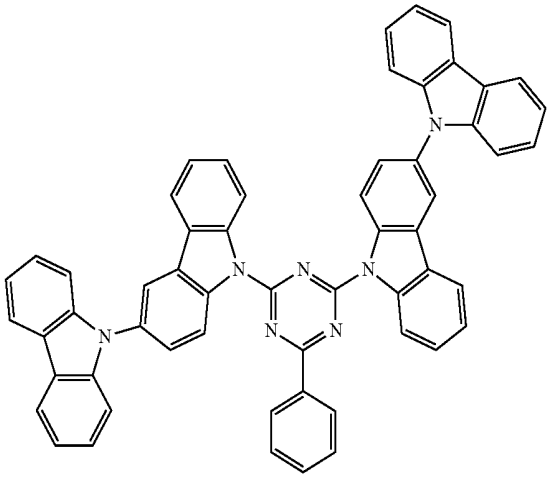
General Formula (161)



wherein in the general formula (161), any two or Y^1, Y^2 and Y^3 each represent a nitrogen atom, and the balance thereof represents a methine group, or all Y^1, Y^2 and Y^3 each represent a nitrogen atom; Z^1 and Z^2 each independently represent a hydrogen atom or a substituent; and R^1 to R^8 each independently represent a hydrogen atom or a substituent, provided that at least one of R^1 to R^9 represents a substituted or ungubsrituted diarylamino group or a substituted or unsubstituted carbazolyl group. The compound represented by the general formula (161) has at least two carbazole structures in the molecule thereof.

[0118] Examples of the compound include the following compounds.

1



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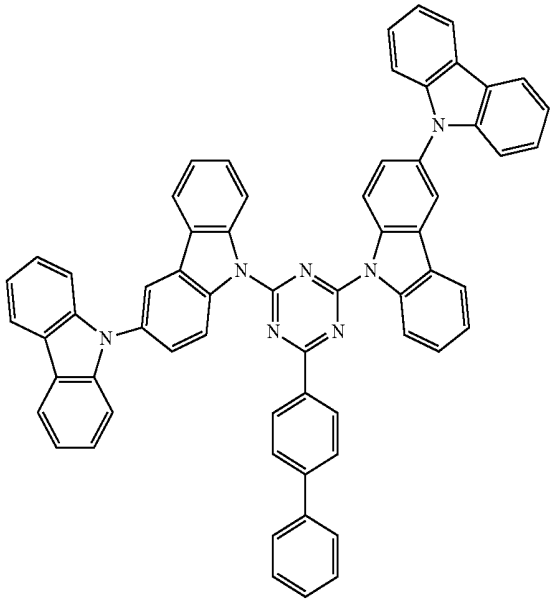

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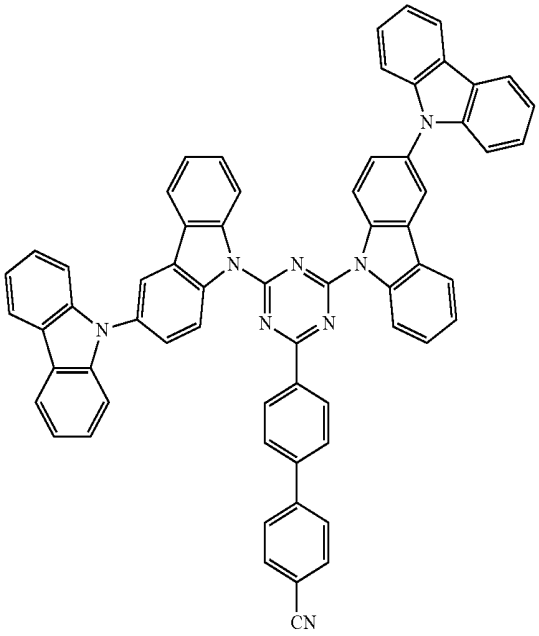

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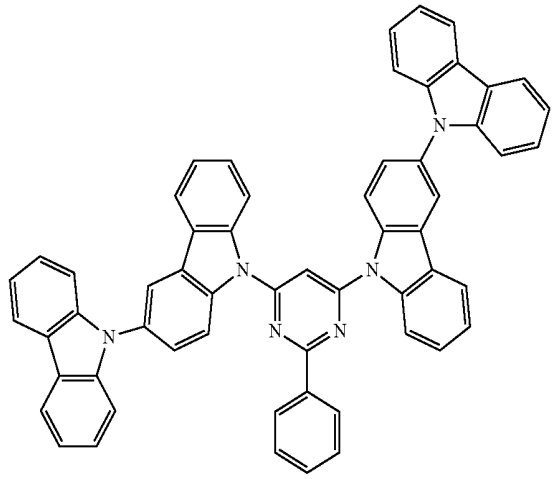

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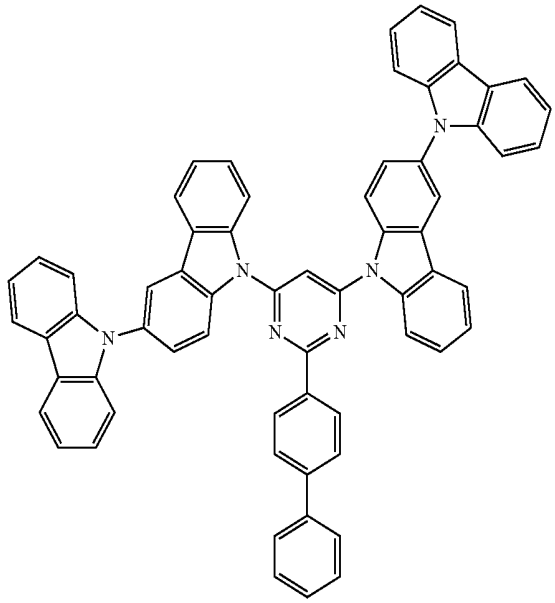

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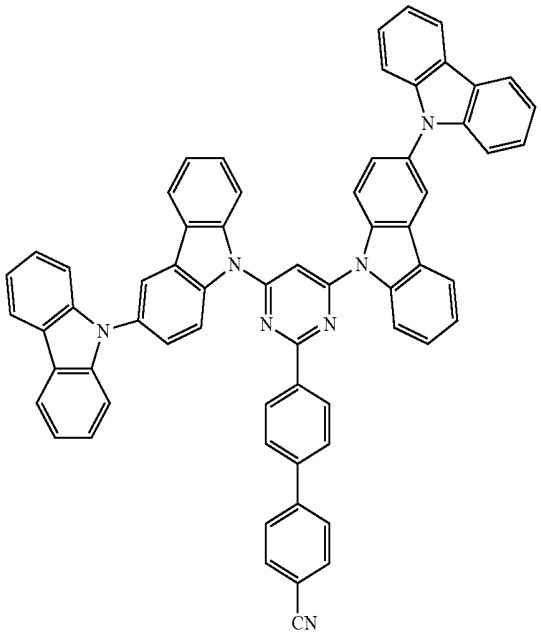

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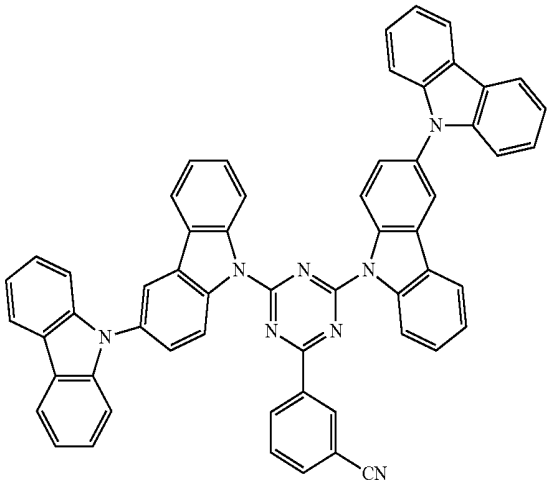

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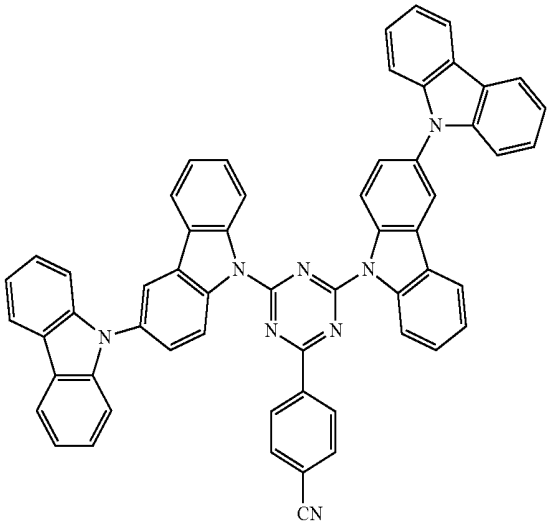

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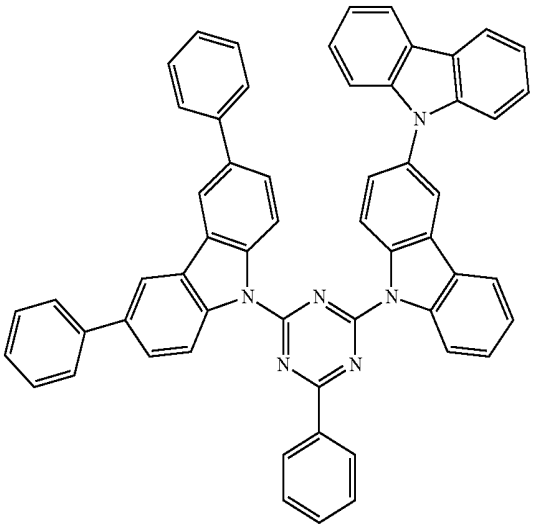

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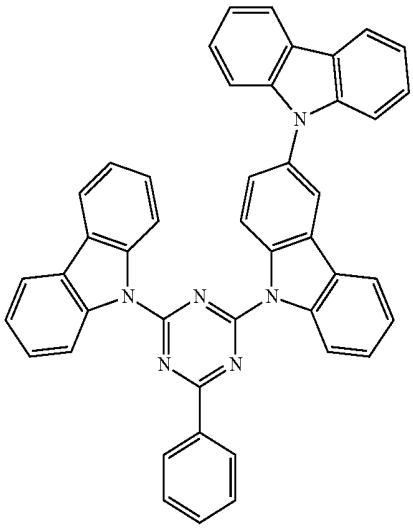

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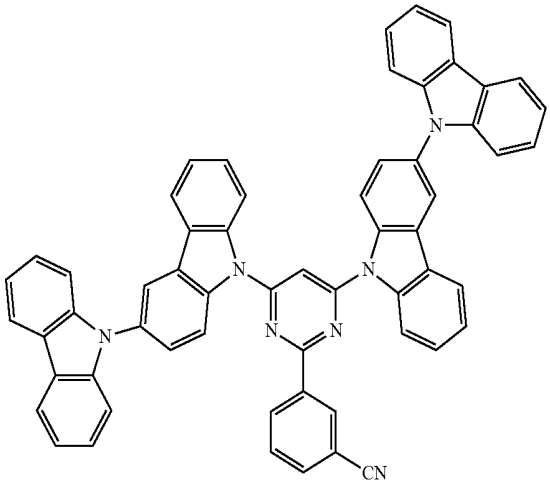

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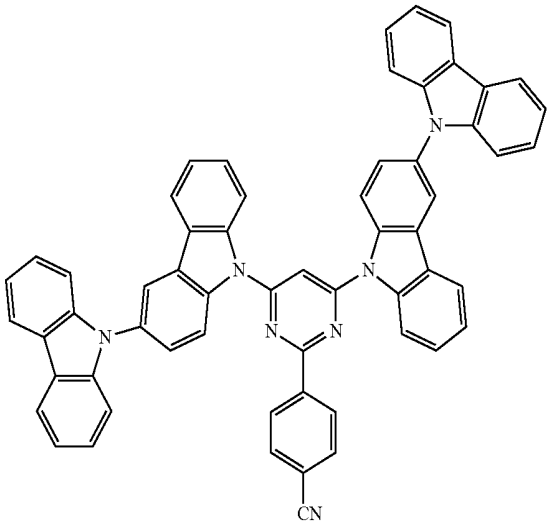

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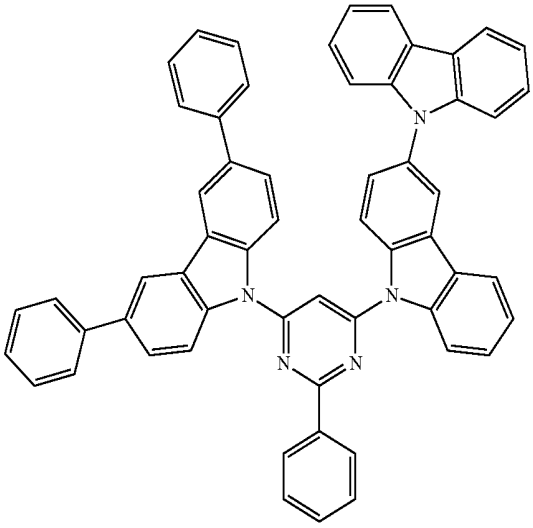

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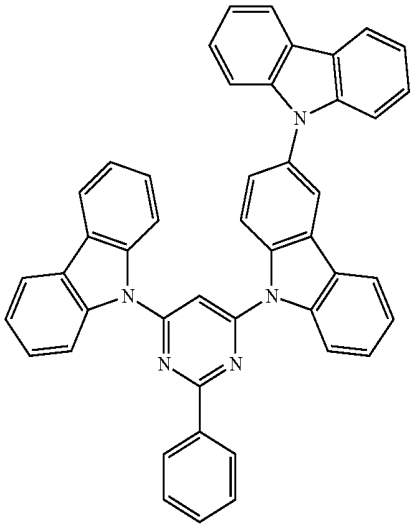

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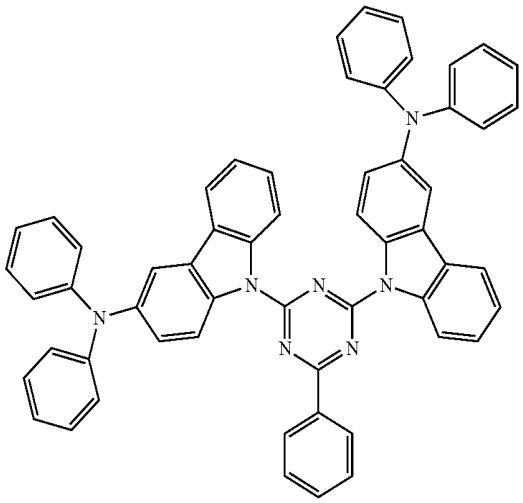

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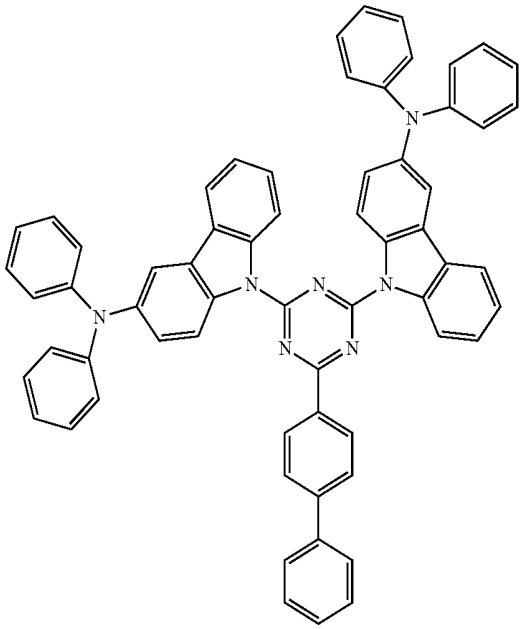

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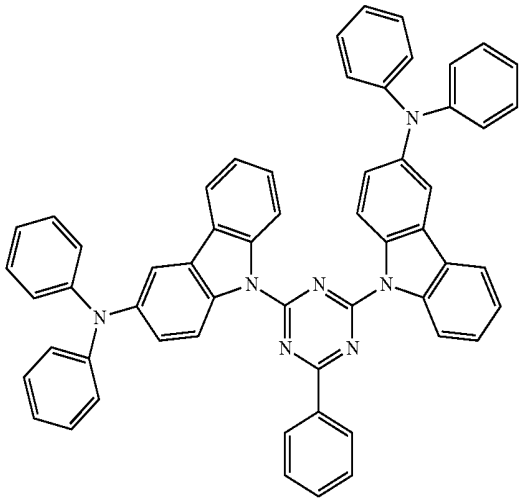

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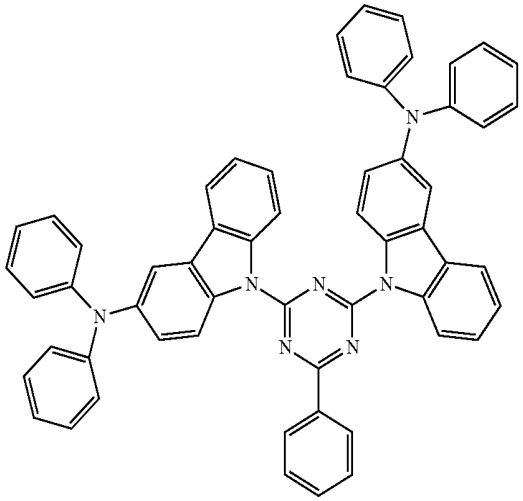

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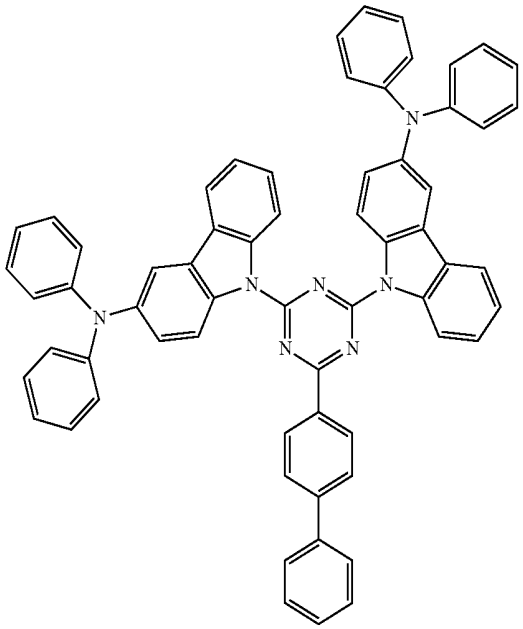

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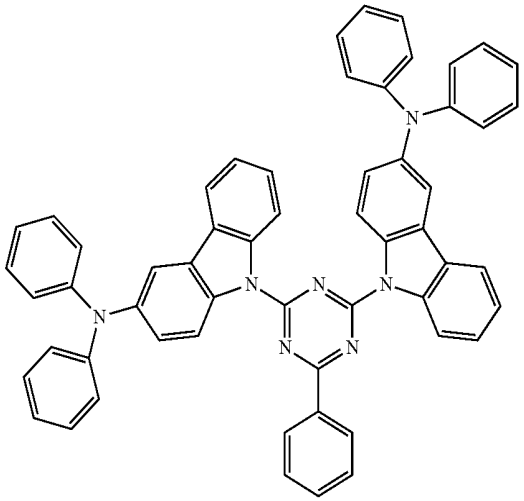

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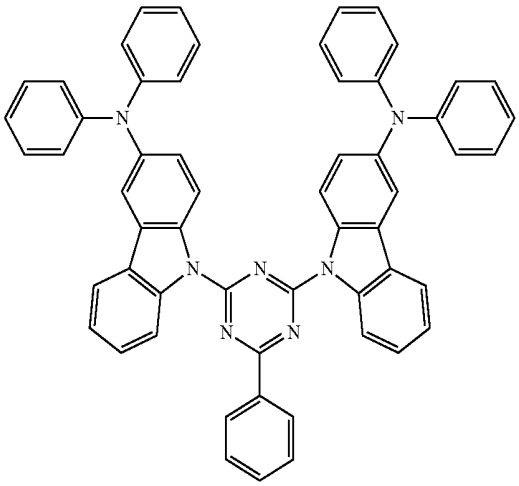

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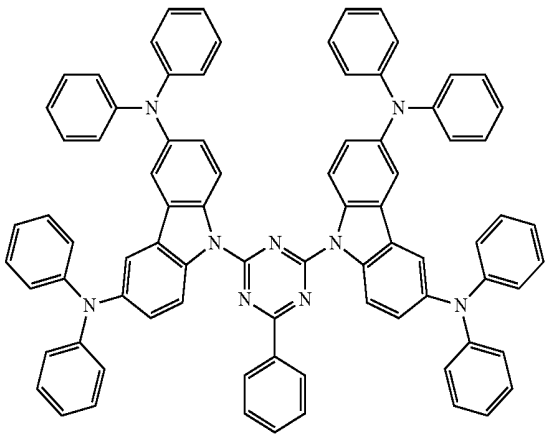

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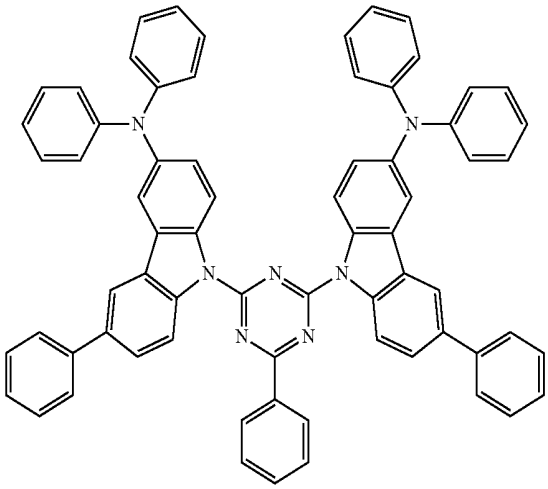

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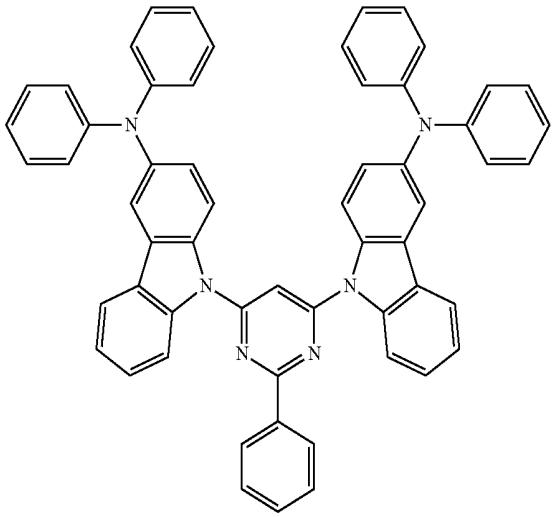

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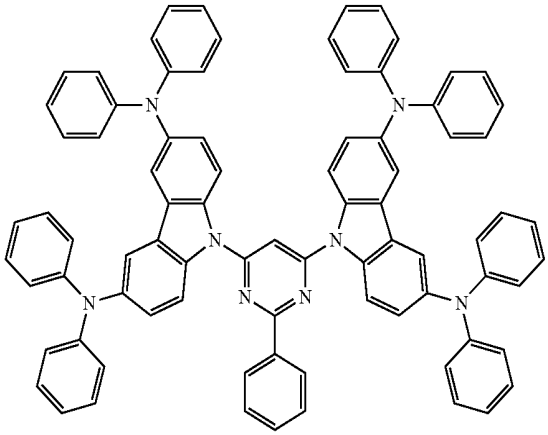

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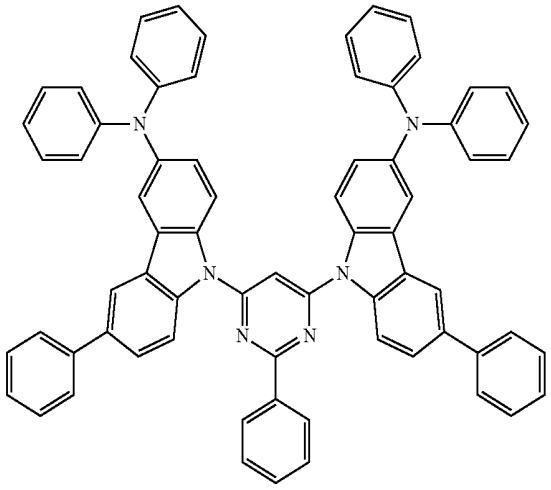

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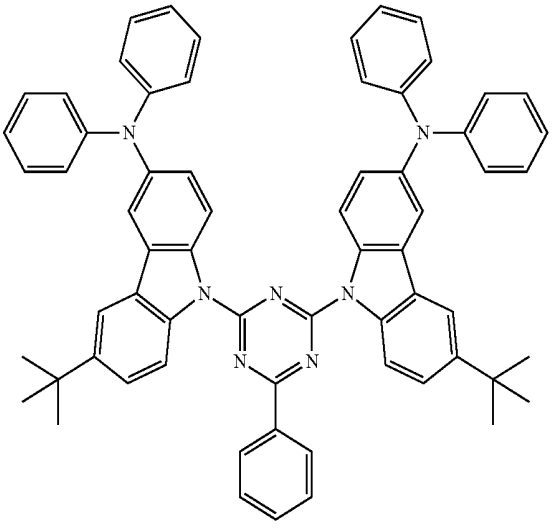

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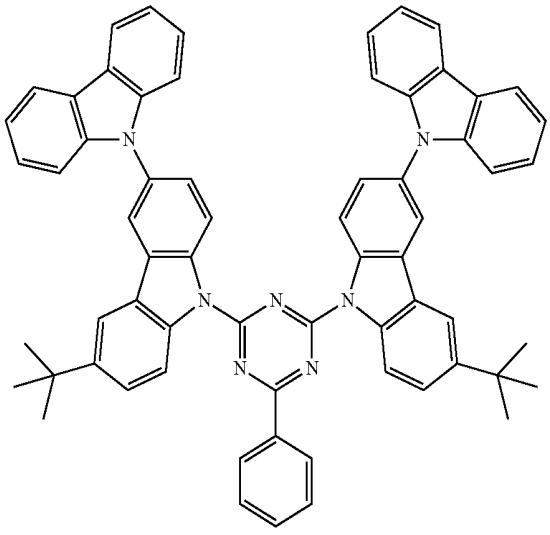

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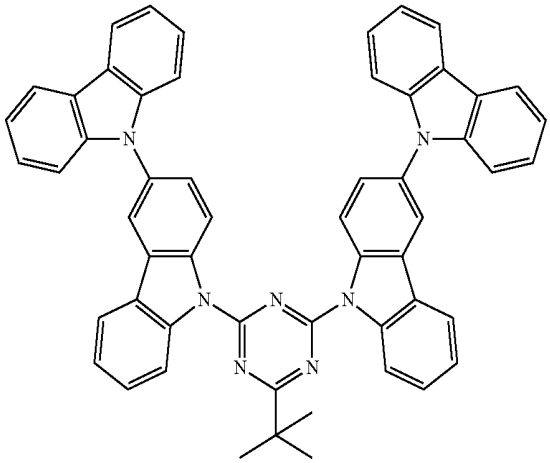

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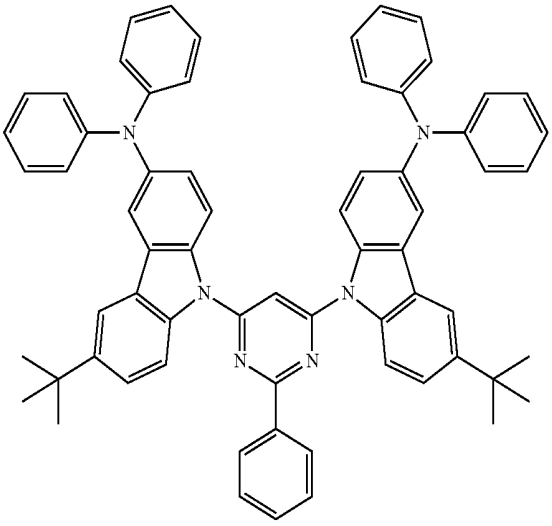

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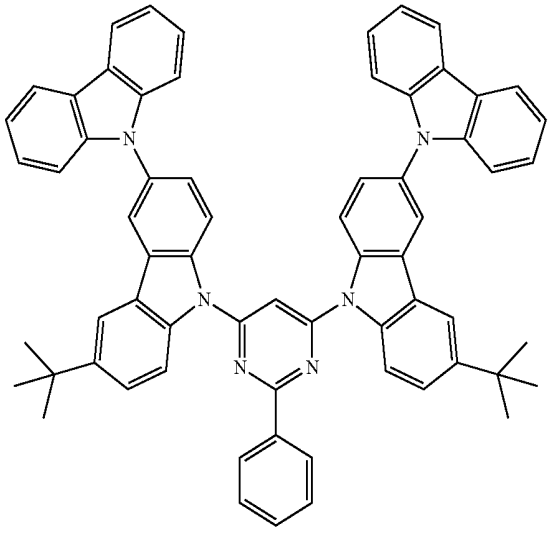

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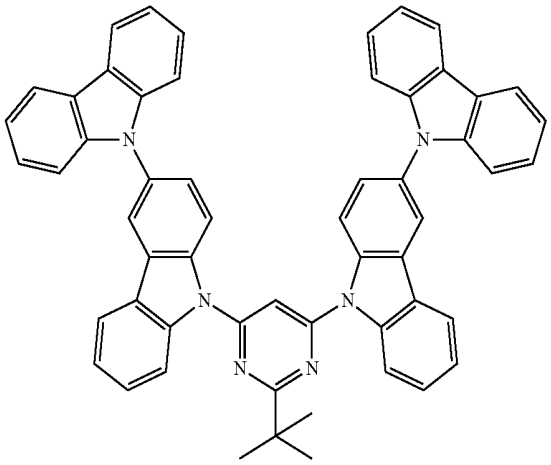

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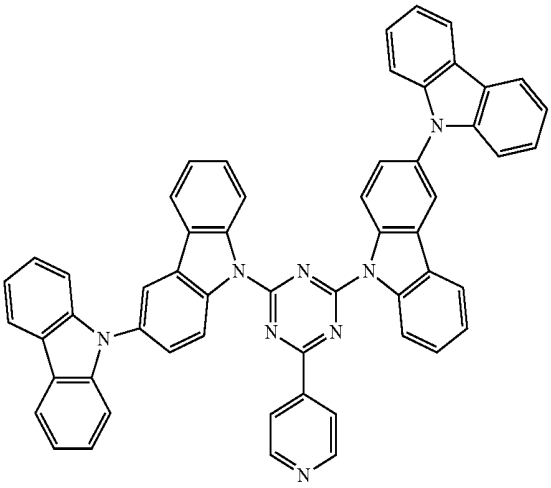

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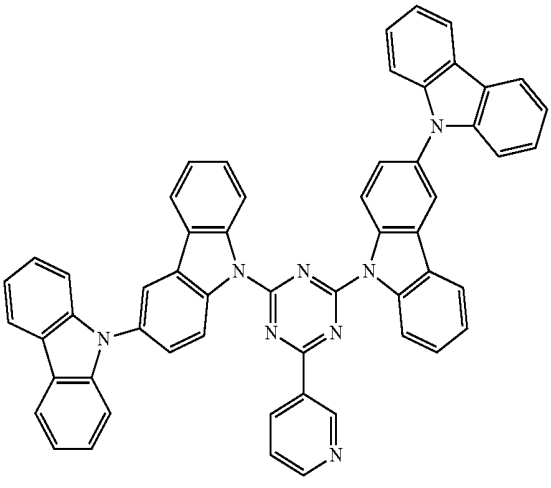

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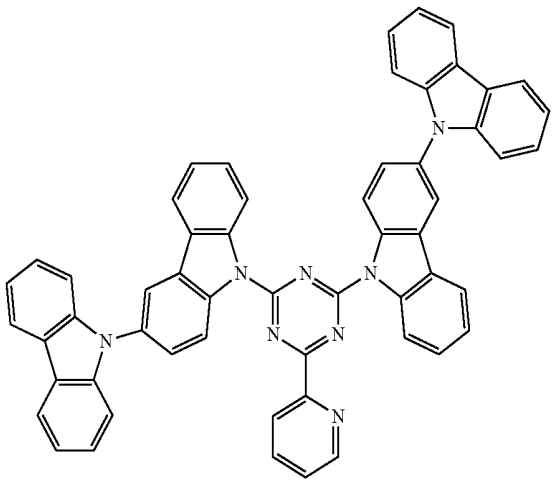

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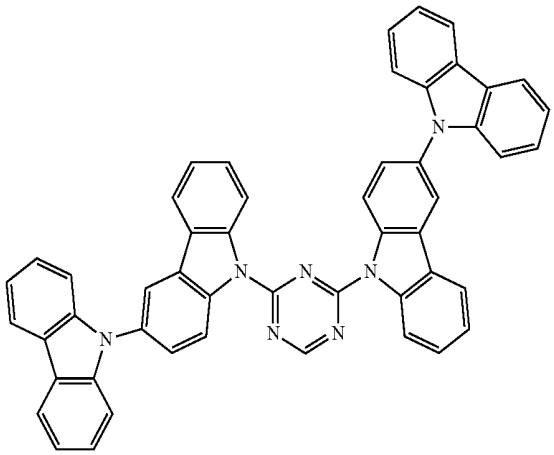

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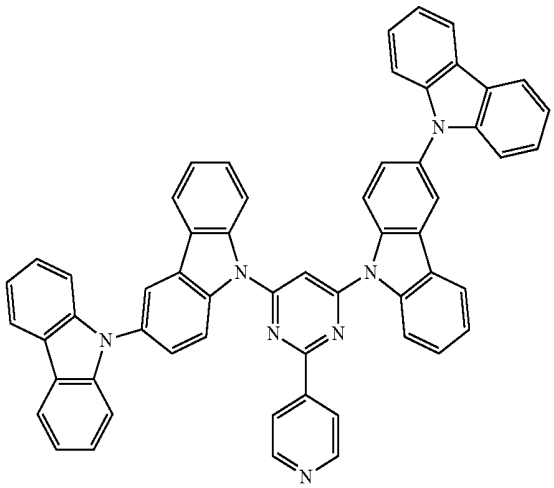

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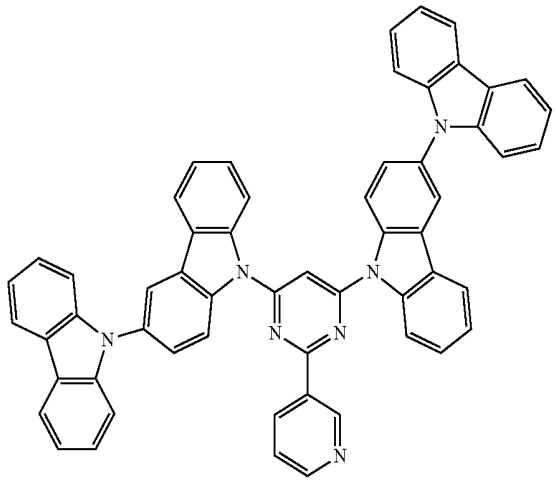

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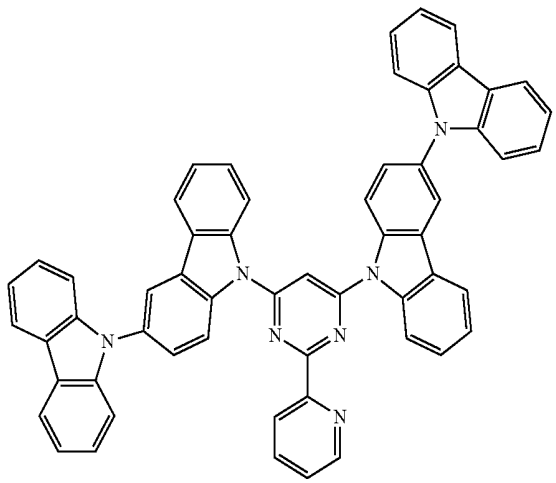

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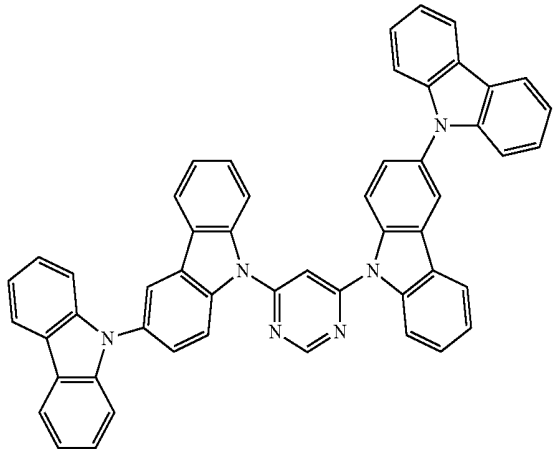

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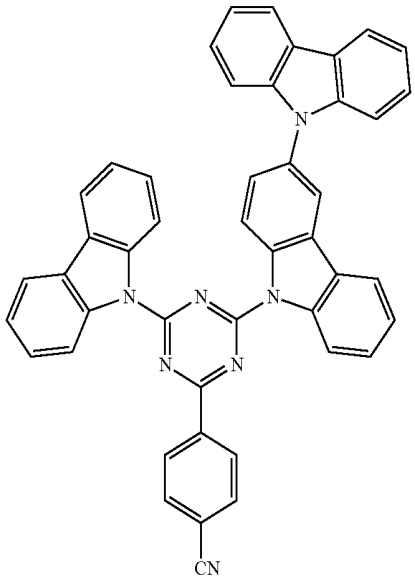

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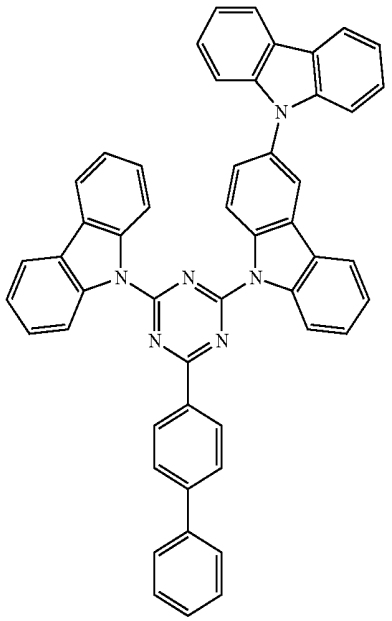

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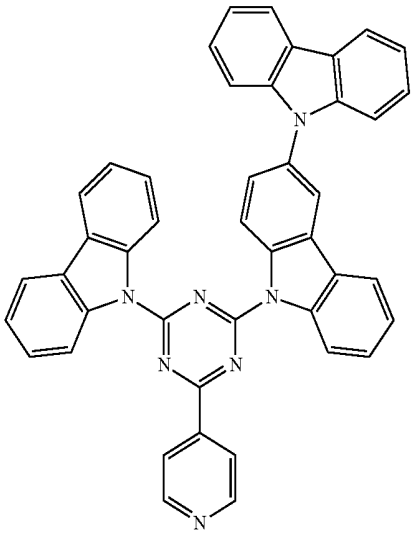

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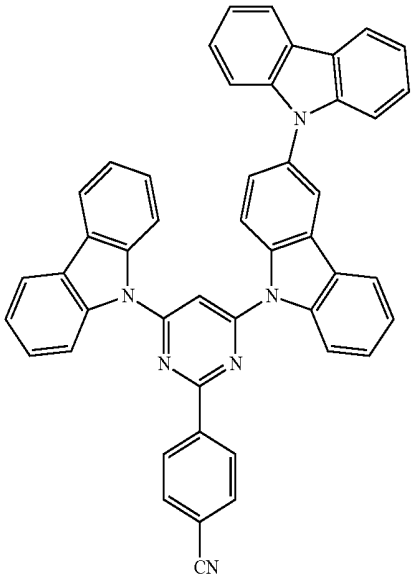

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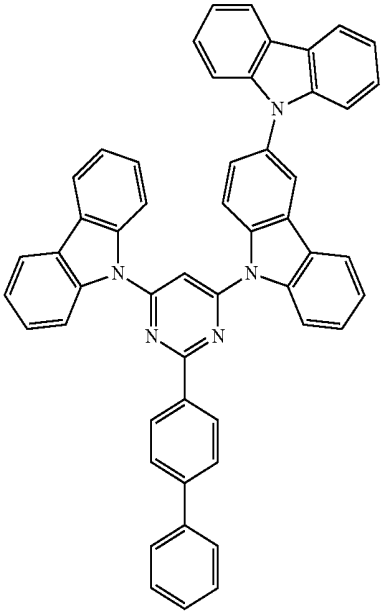

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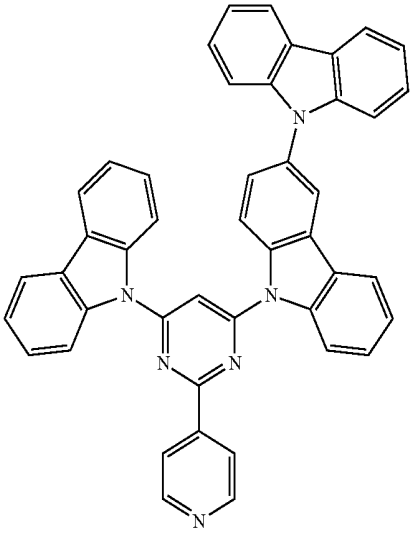

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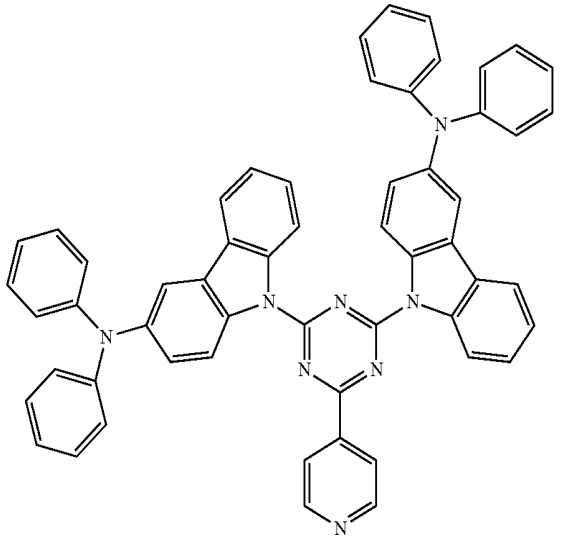

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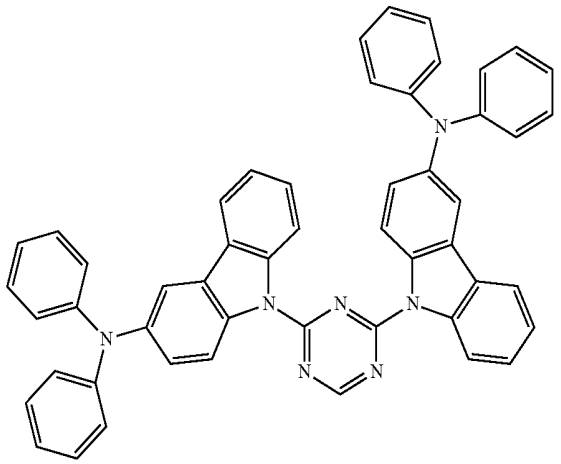

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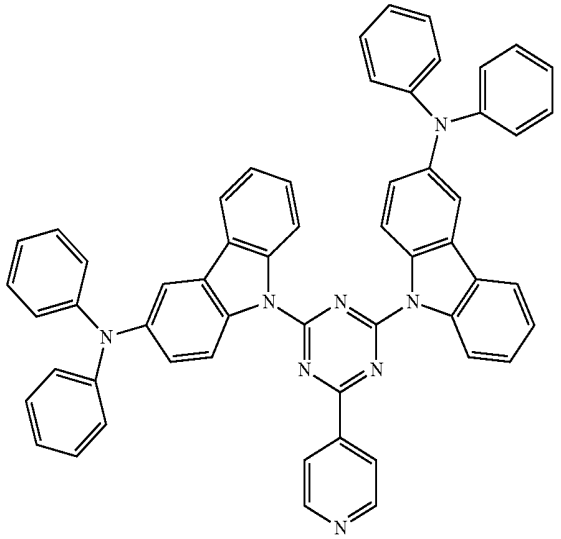

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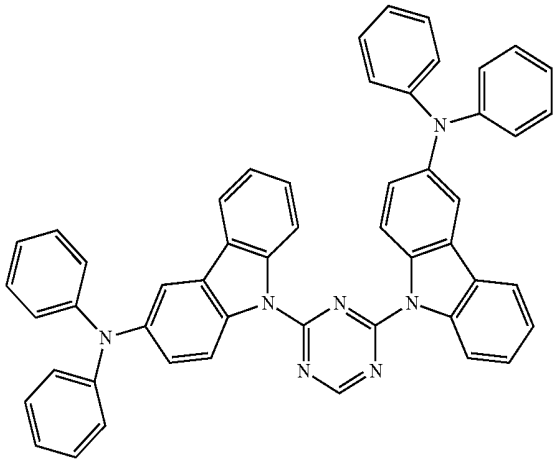

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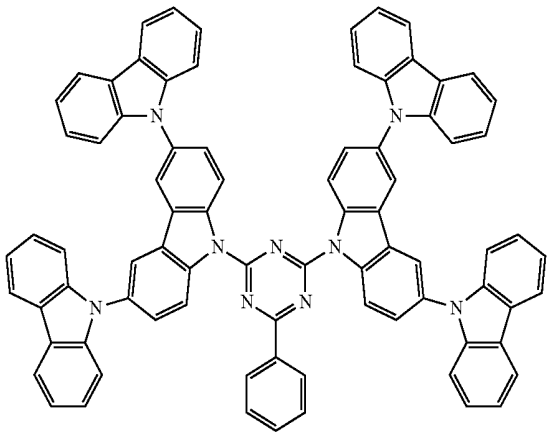

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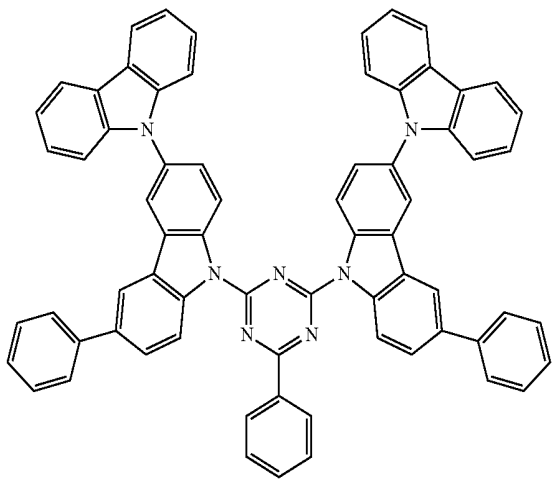

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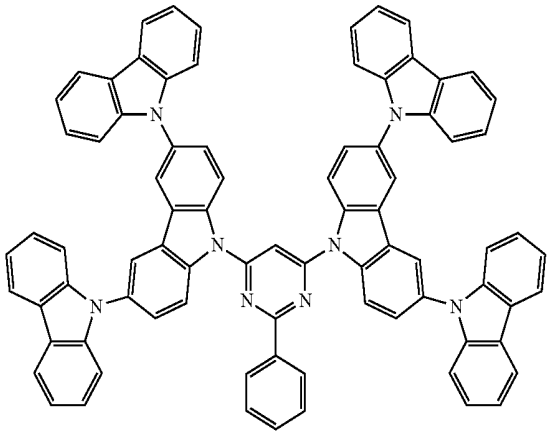

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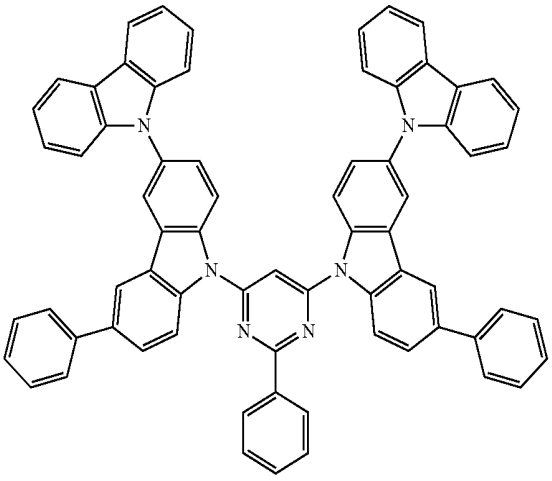

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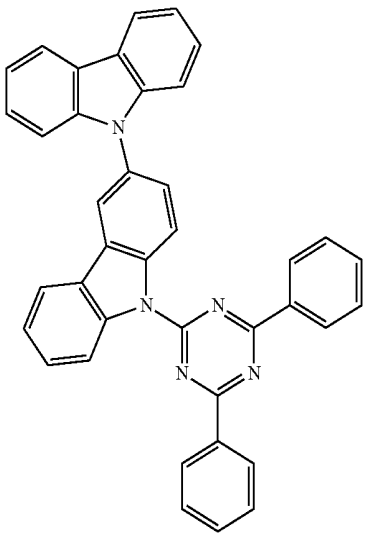

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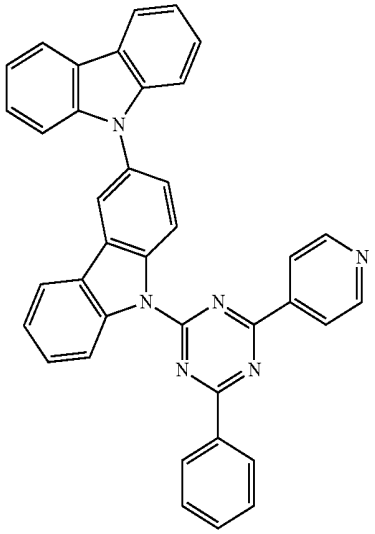

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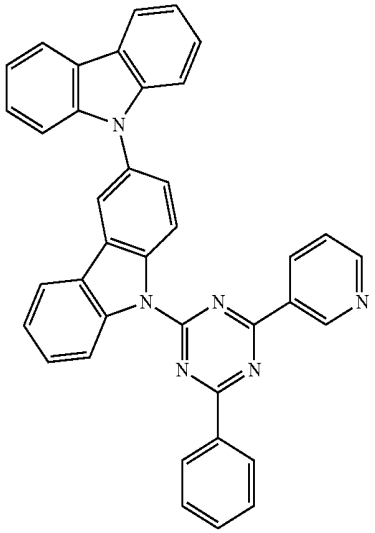

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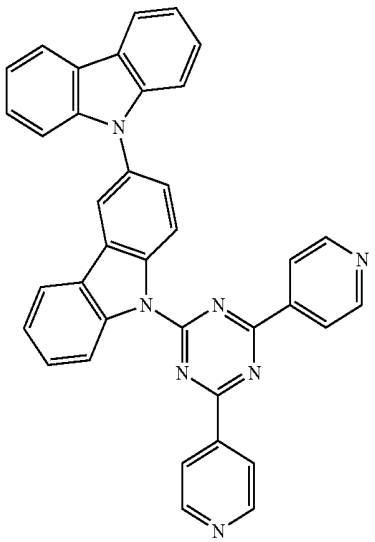

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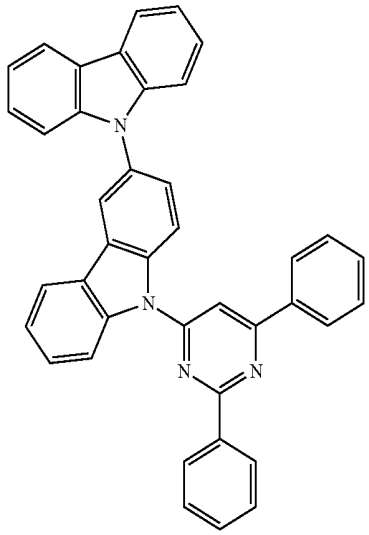

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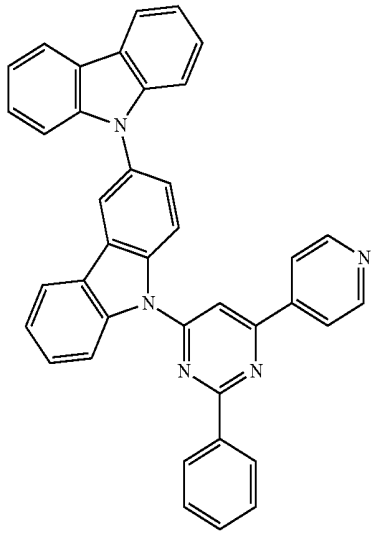

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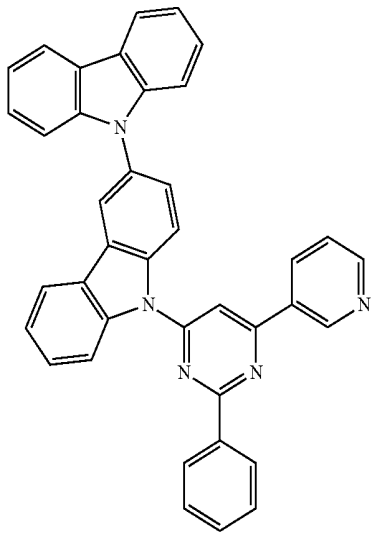

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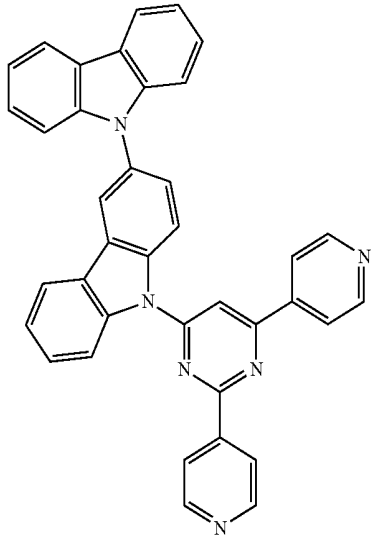

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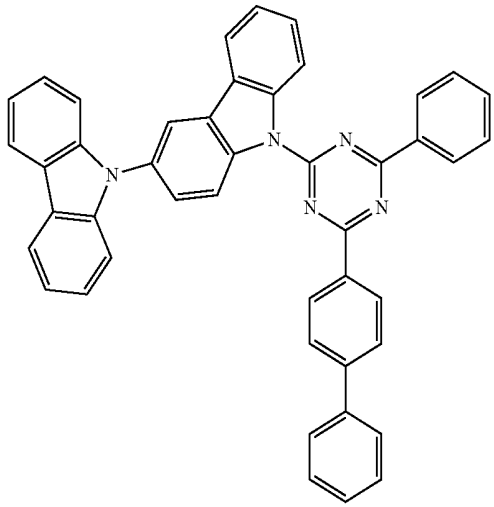

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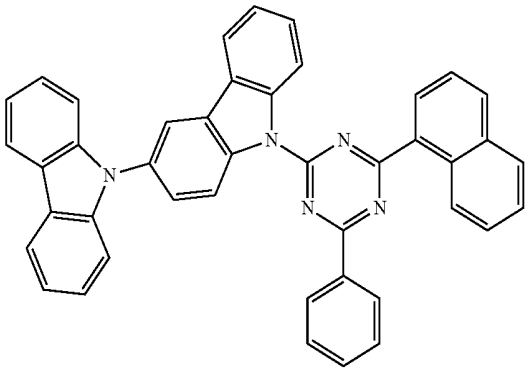

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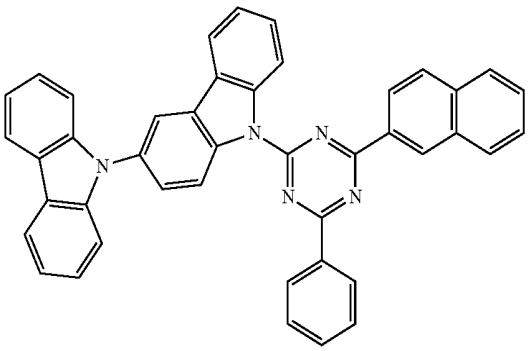

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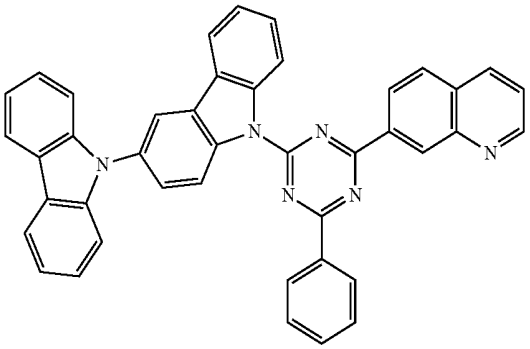

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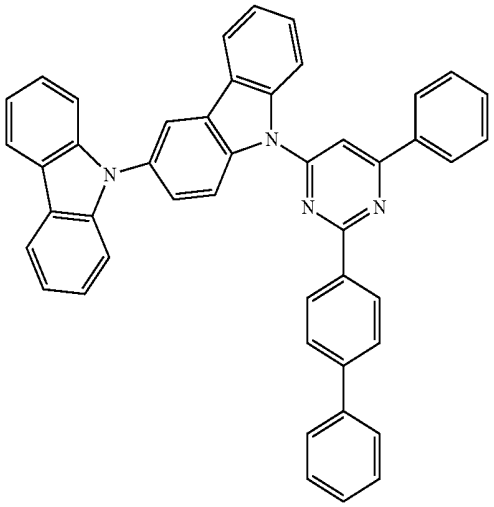

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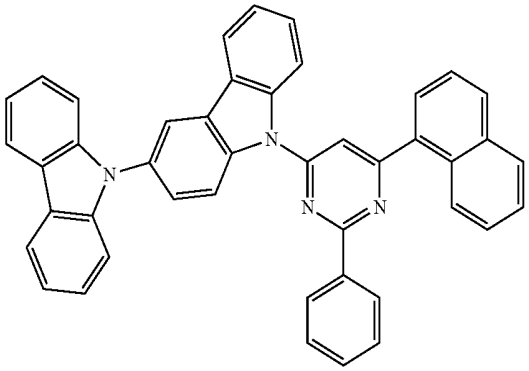

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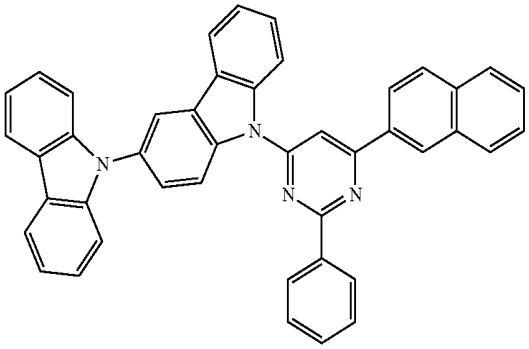

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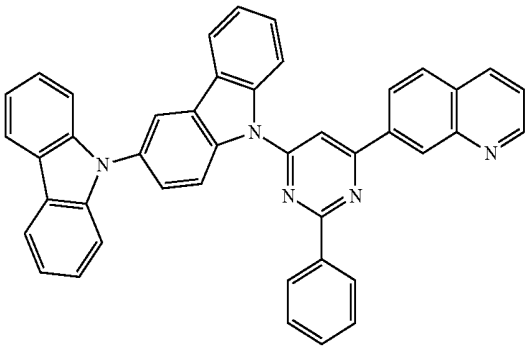

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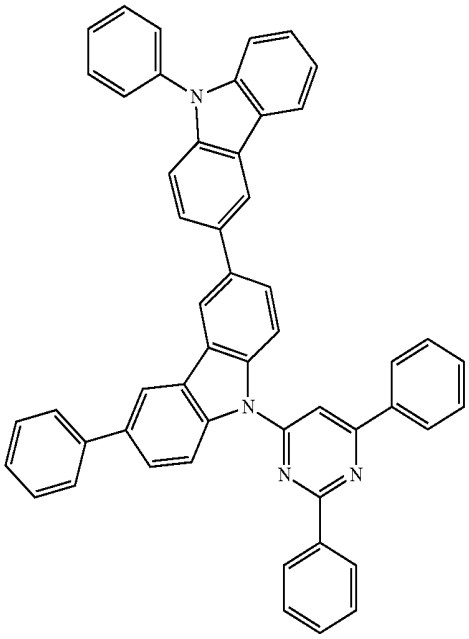

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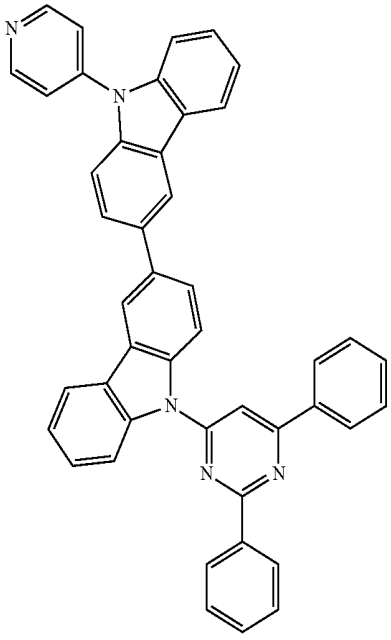

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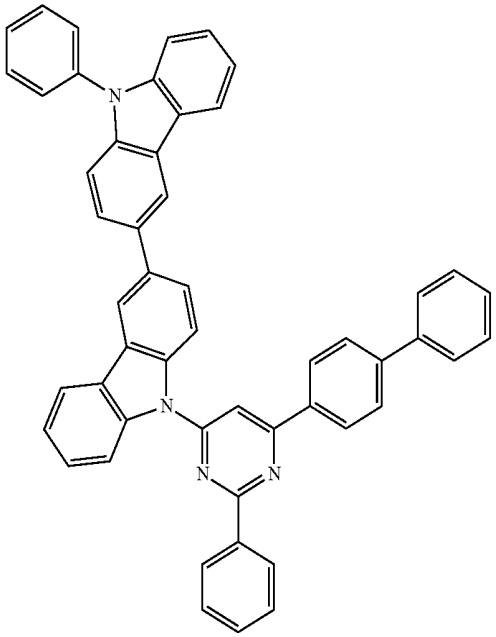

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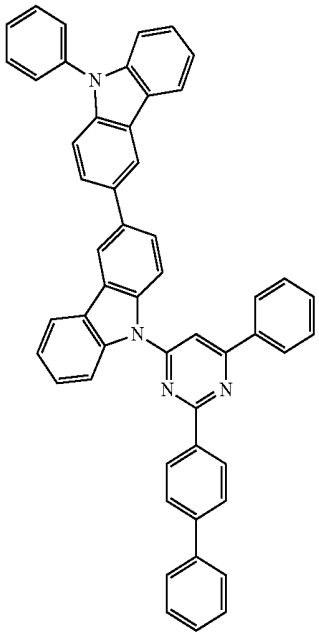

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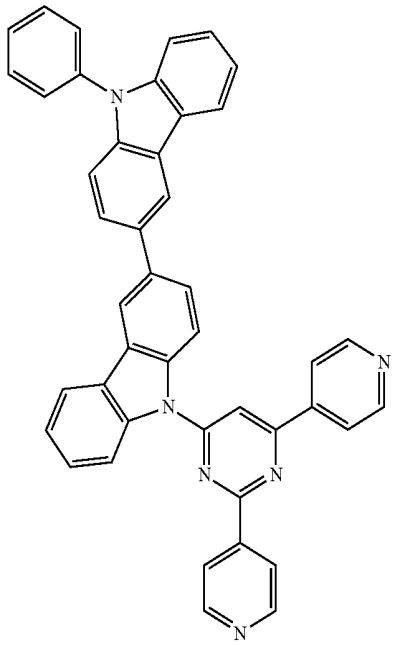

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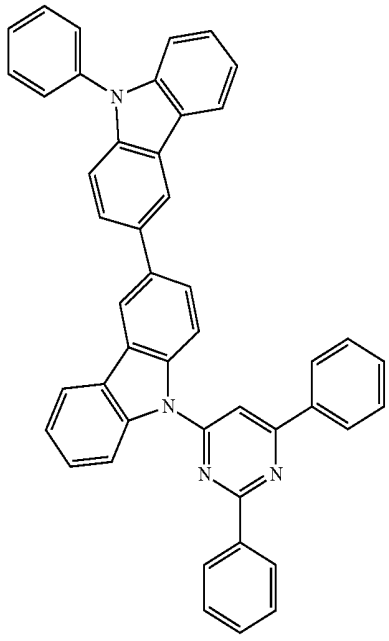

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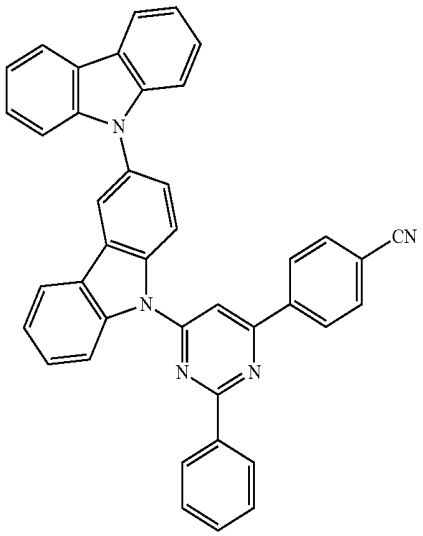

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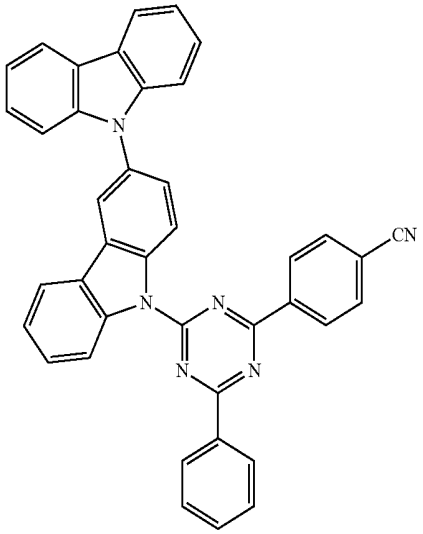

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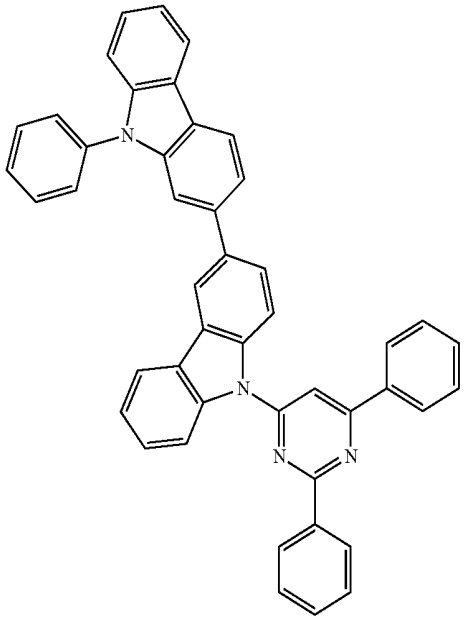

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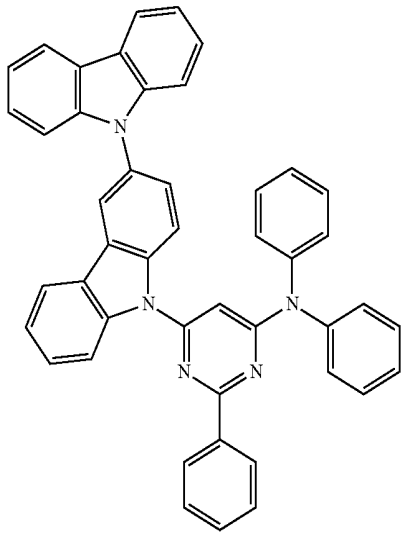

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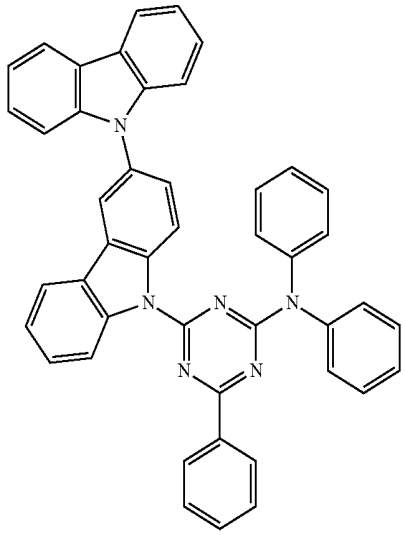

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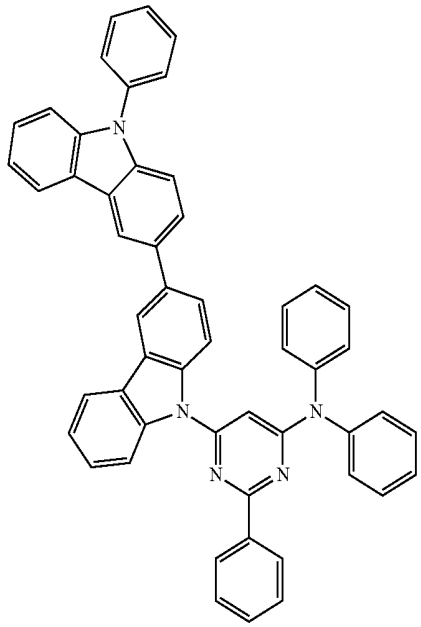

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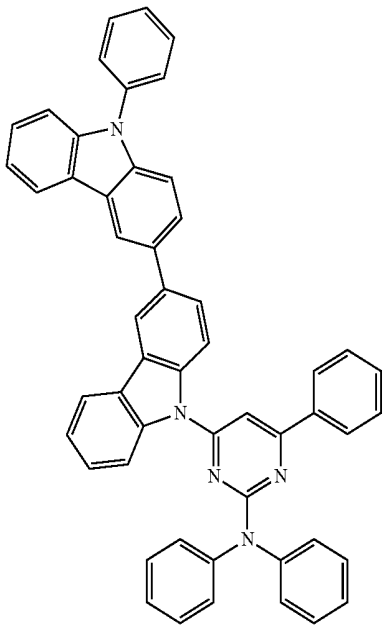

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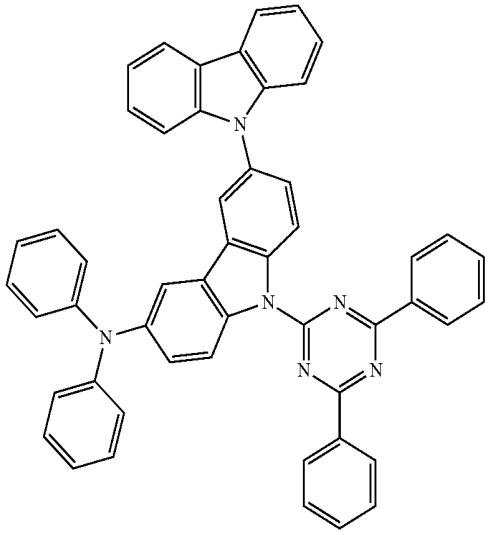

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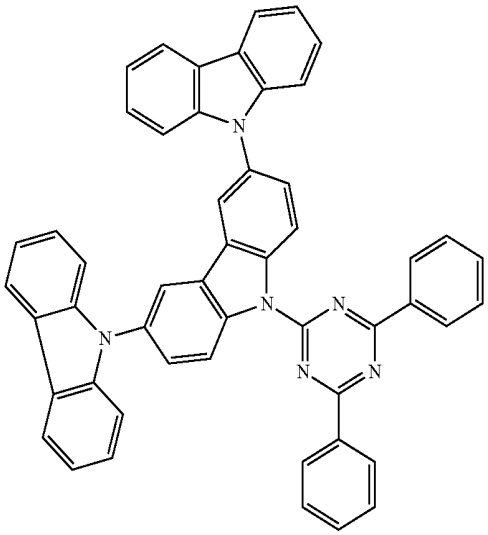

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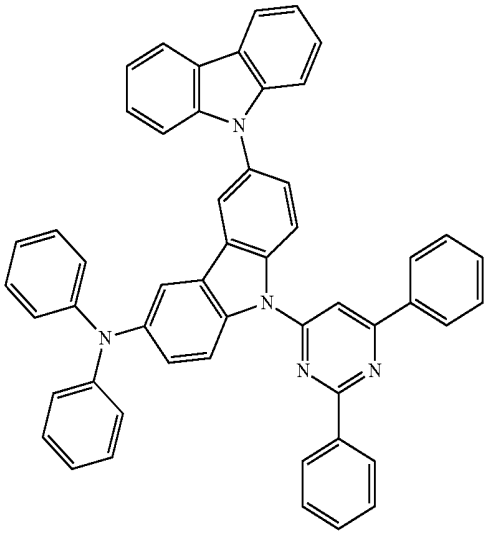

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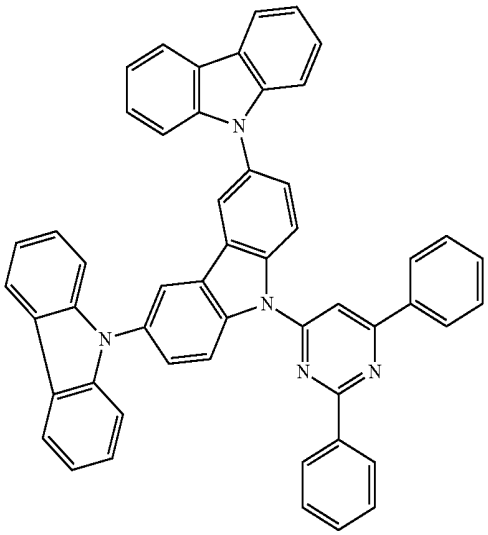

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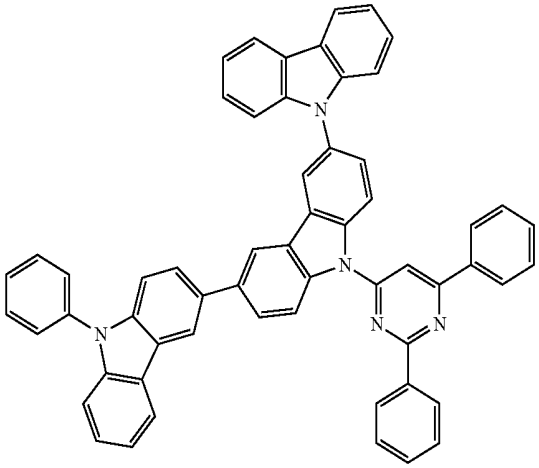

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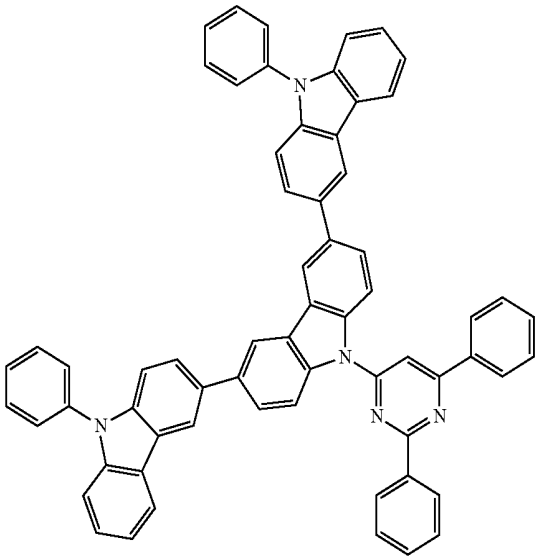
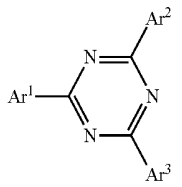


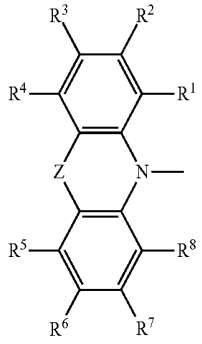
[0119] Examples of the preferred light-emitting material include compounds represented by the following general formula (171). The entire description of JP-A-2013-256490 including the paragraphs 0009 to 0046 and 0093 to 0134 is incorporated herein by reference.

General Formula (171)



wherein in the general formula (171), Ar^1 to Ar^2 each independently represent a substituted or unsubstituted aryl group, provided that at least one thereof represents an aryl group substituted with a group represented by the following general formula (172).

General Formula (172)



wherein in the general formula (172), R^1 to R^2 each independently represent a hydrogen atom or a substituent; Z represents O, S, O═C, or Ar^4—N; and Ar^4 represents a substituted or unsubstituted aryl group, provided that R^1 and R^2, R^2 and R^3, R^3 and R^4, R^5 and R^6, R^6 and R^7, and R^7 and R^8 each may be bonded to each other to form a cyclic structure.

[0120] Examples of the compound include the following compounds.

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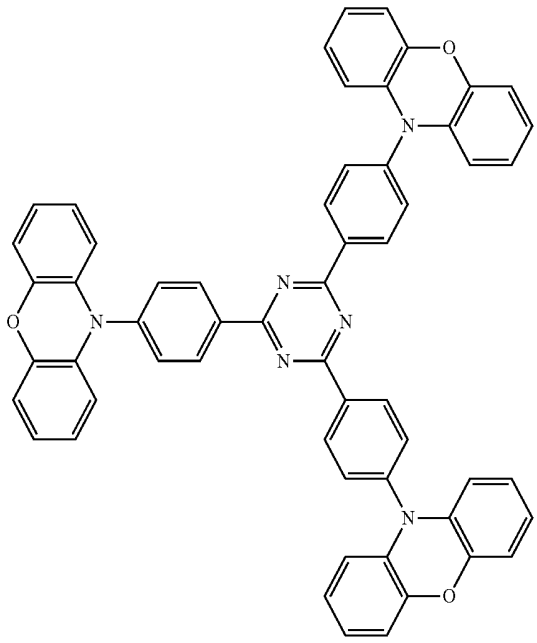

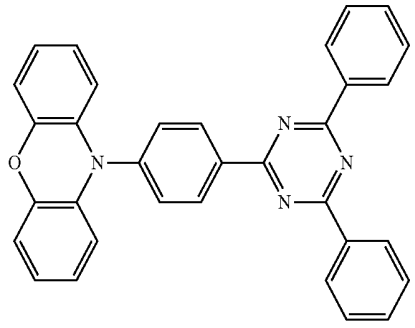

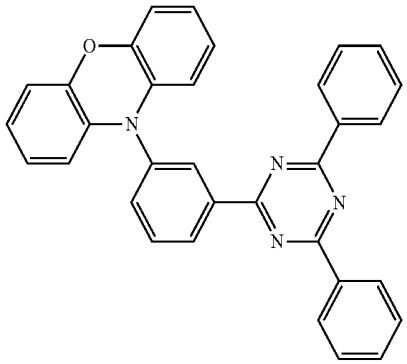

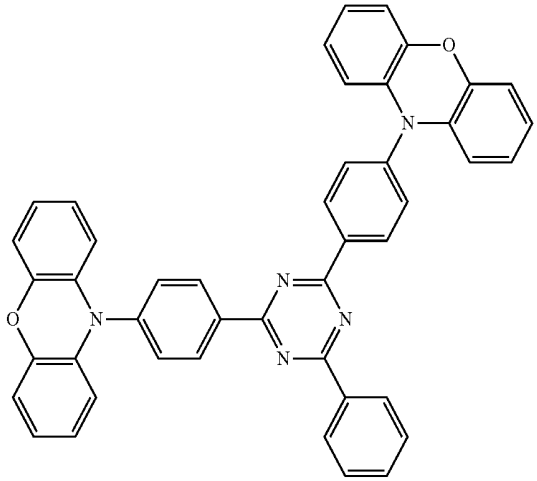

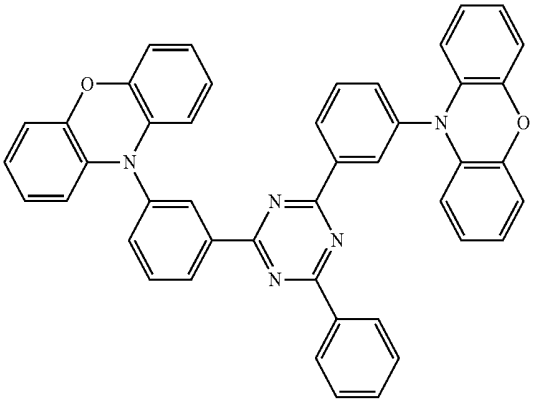

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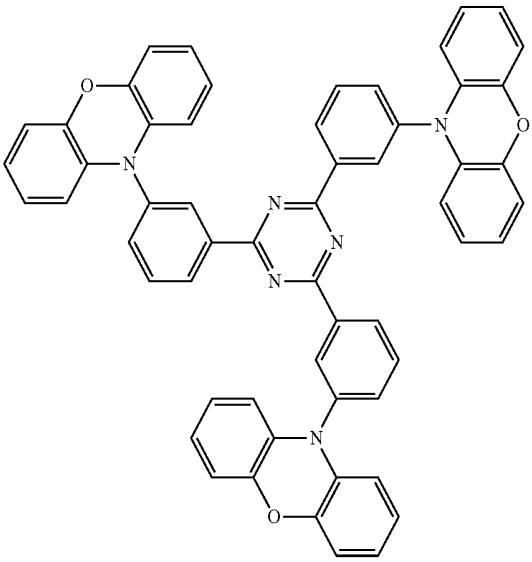

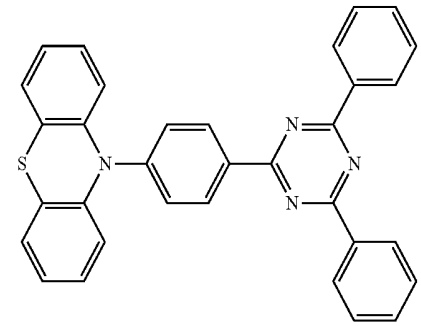

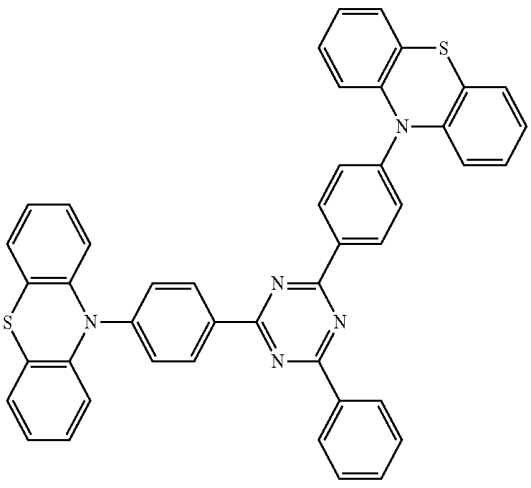

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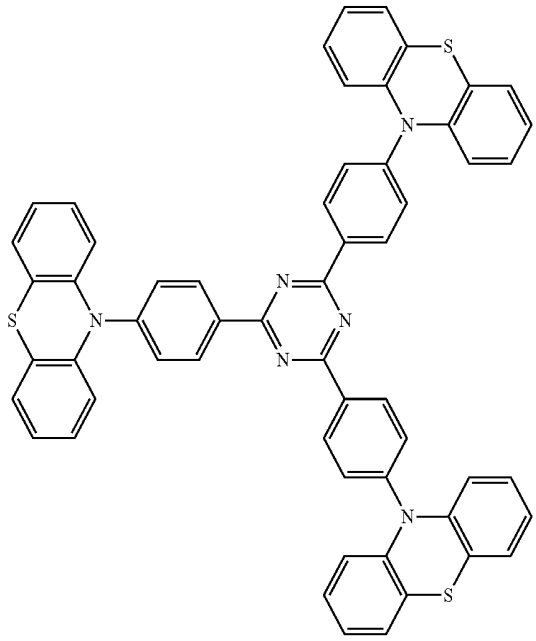

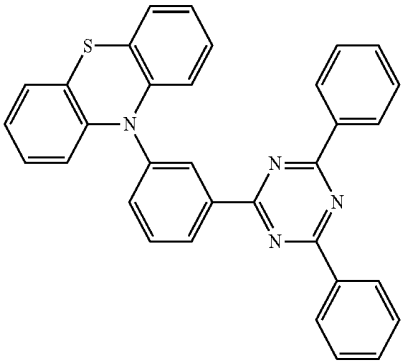

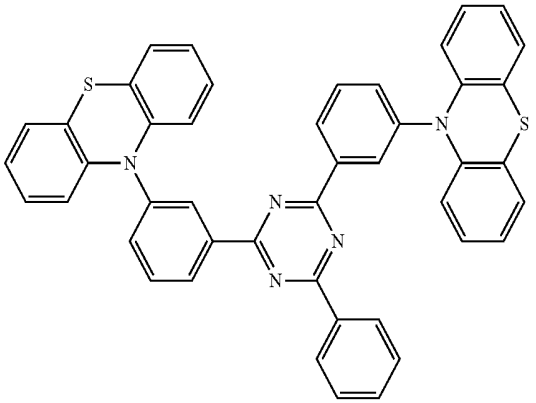

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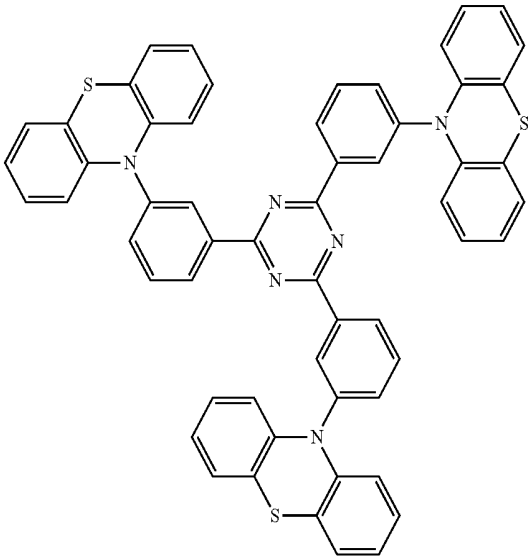

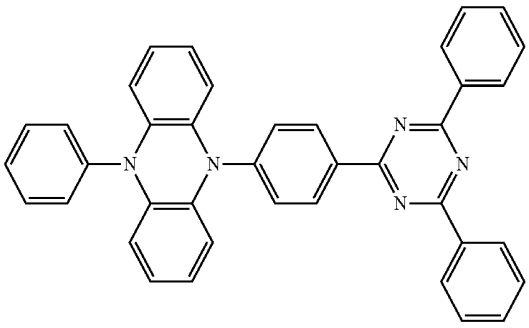

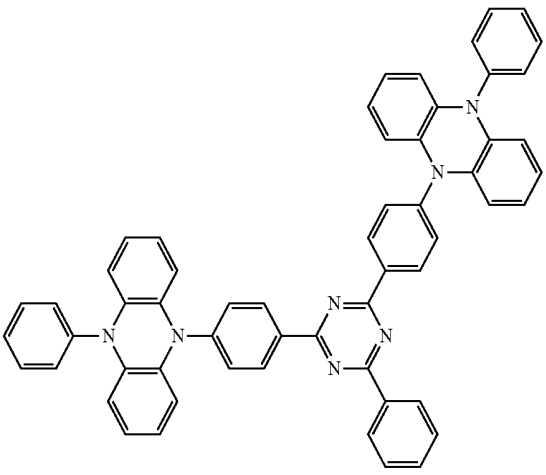

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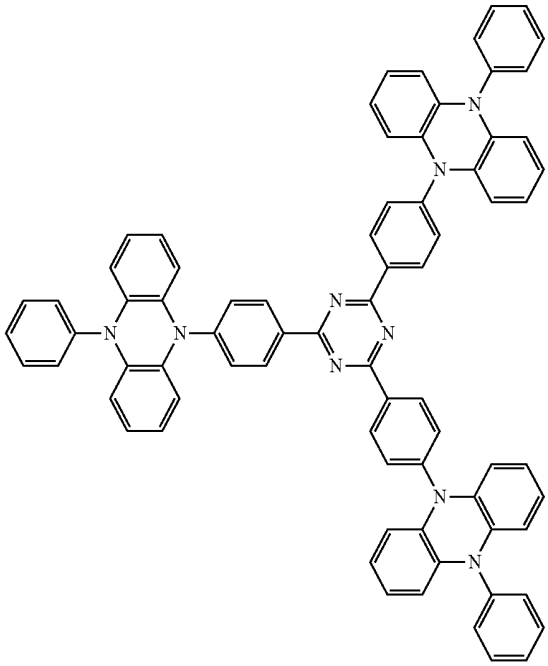

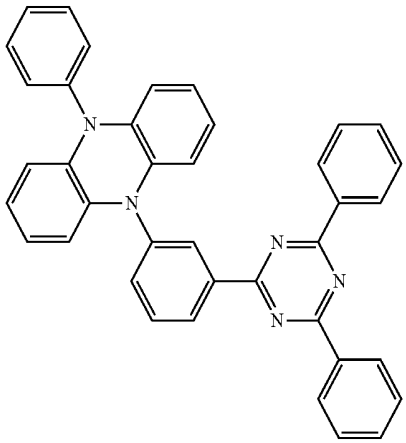

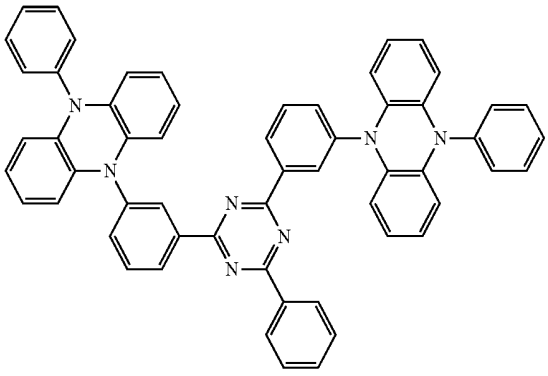

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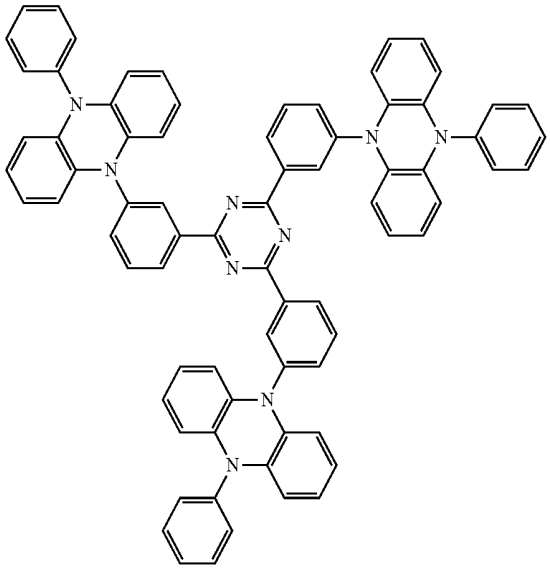

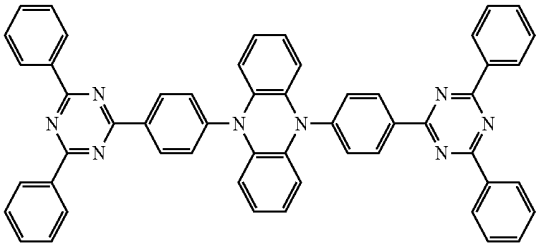

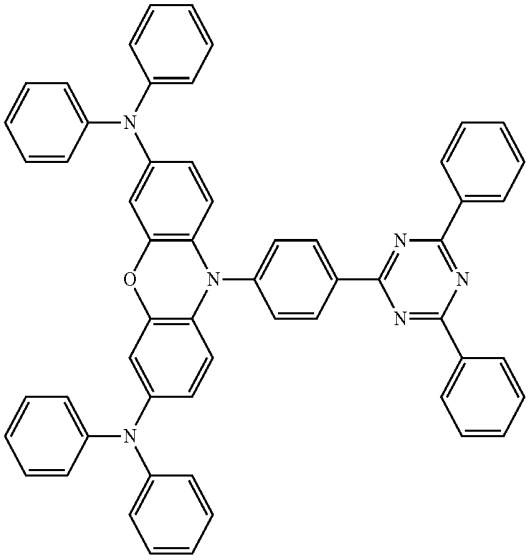

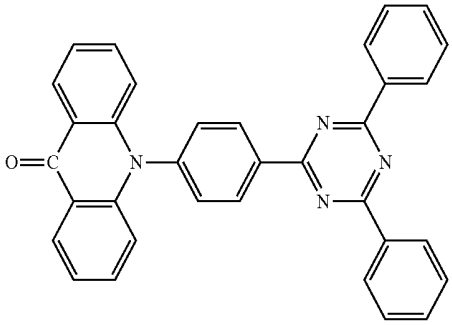

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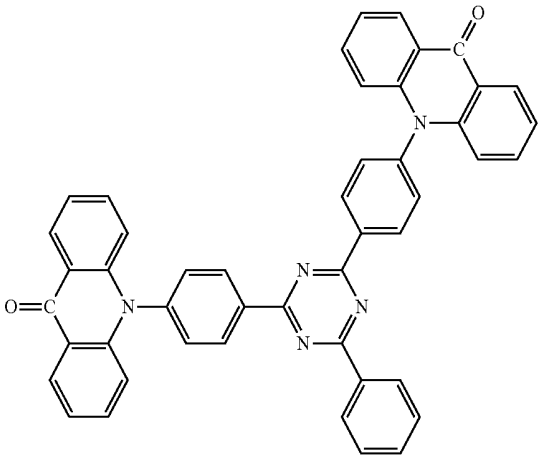

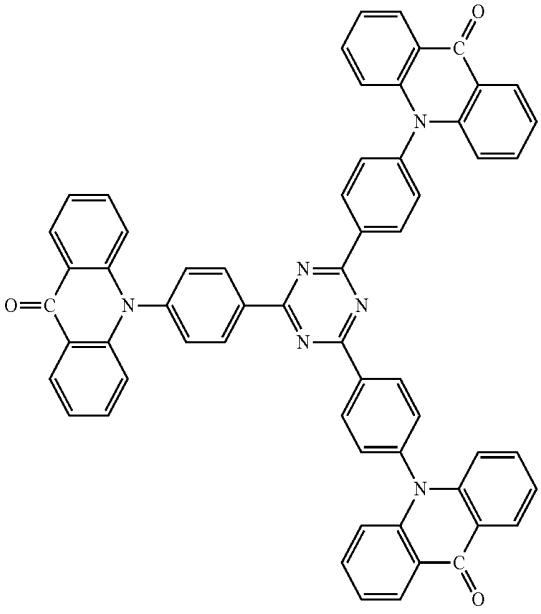

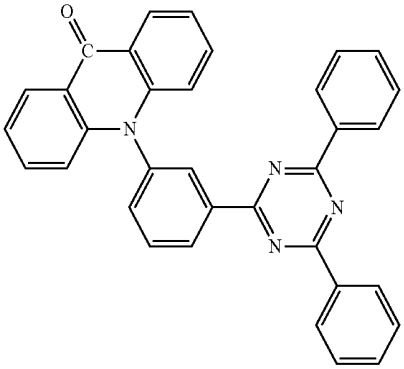

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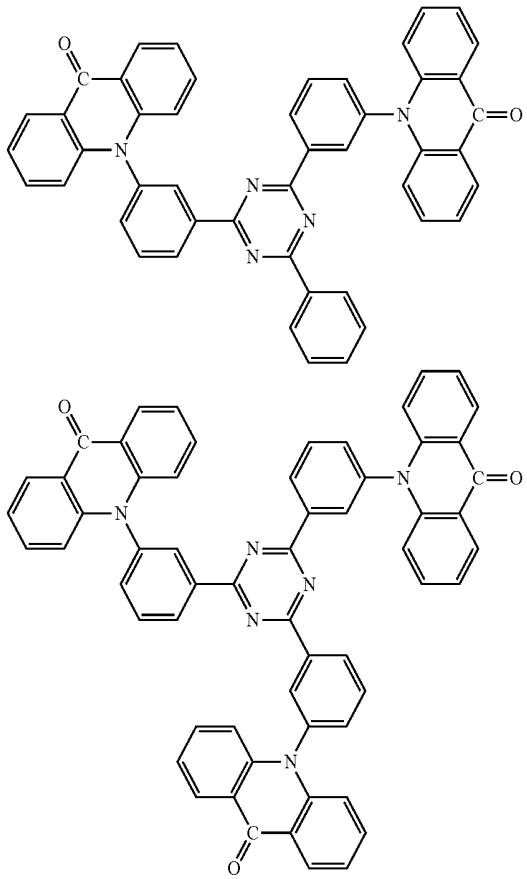
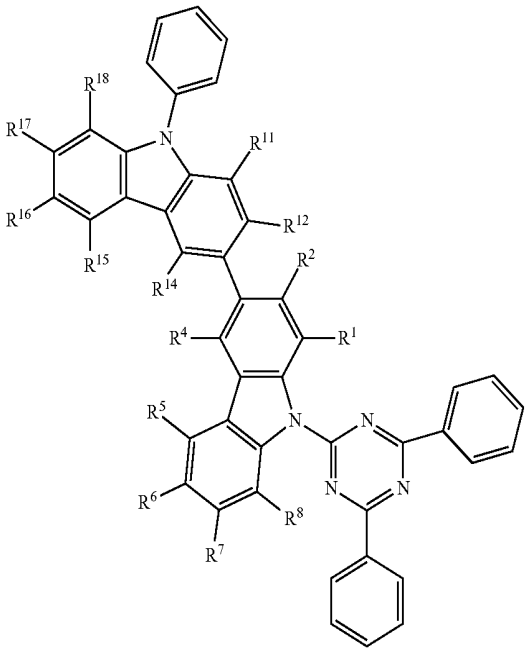


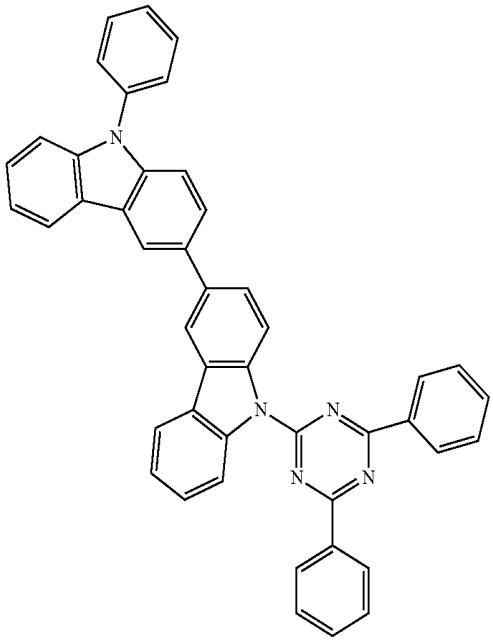
[0121] Examples of the preferred light-emitting material include compounds represented by the following general formula (161). The entire description of JP-A-2013-116975 including the paragraphs 0008 to 0020 and 0038 to 0040 is incorporated herein by reference.

General Formula (181)



wherein in the general formula (181), R^1, R^2, R^4 to R^8, R^{11}, R^{12} and R^{14} to R^{18} each independently represent a hydrogen atom or a substituent.

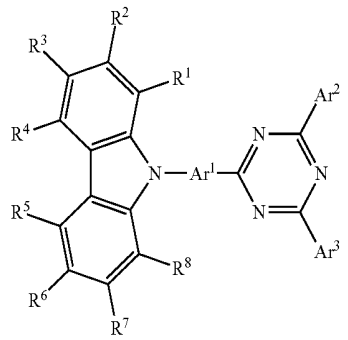
[0122] Examples of the compound include the following compound.



[0123] Examples of the preferred light-emitting material include the following compounds.

[0124] (1) A compound represented by the following general formula (191):

General Formula (191)



wherein in the general formula (191), Ar^1 represents, a substituted or unsubstituted arylene group; Ar^2 and Ar^3 each independently represent a substituted or unsubstituted aryl group; and R^1 to R^8 each independently represent a hydrogen atom or a substituent, provided that at least one of R^1 to R^8 represents a substituted or unsubstituted diarylamino group, and R^1 and R^2, R^2 and R^3, R^3 and R^4, R^5 and R^6, R^6 and R^7, and R^7 and R^8 each nay be bonded to each other to form a cyclic structure.

[0125] (2) The compound according to the item (1), wherein in the general formula (191), at least one of R^1 to R^4 represents a substituted or unsubstituted diarylamino group, and at least one of R^5 to R^8 represents a substituted or unsubstituted diarylamino group.

[0126] (3) The compound according to the item (2), wherein in the general formula (191), R^3 and R^6 each represent a substituted or unsubstituted diarylamino group.

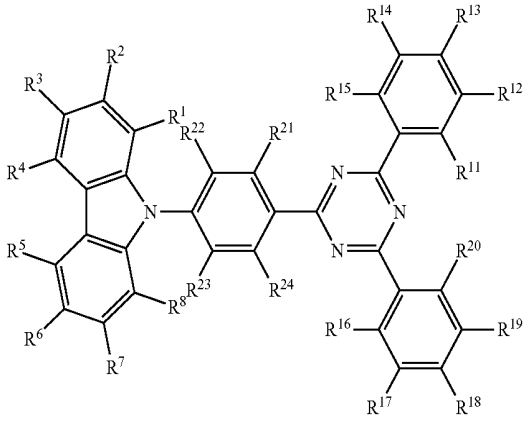
[0127] (4) The compound according to any one of the items (1) to (3), wherein in the general formula (191), at least one of R^1 to R^8 represents a substituted or unsubstituted diphenylamino group.

[0128] (5) The compound according to any one of the items (1) to (4), wherein in the general formula (191), Ar^2 and Ar^3 each independently represent a substituted or unsubstituted phenyl group.

[0129] (6) The compound according to any one of the items (1) to (5), wherein in the general formula (191), Ar^1 represents a substituted or unsubstituted phenylene group, a substituted or unsubstituted naphthylene group or a substituted or unsubstituted anthracenylene group.

[0130] (7) The compound according to the item (1), wherein the compound has a structure represented by the following general formula (192):

General Formula (192)

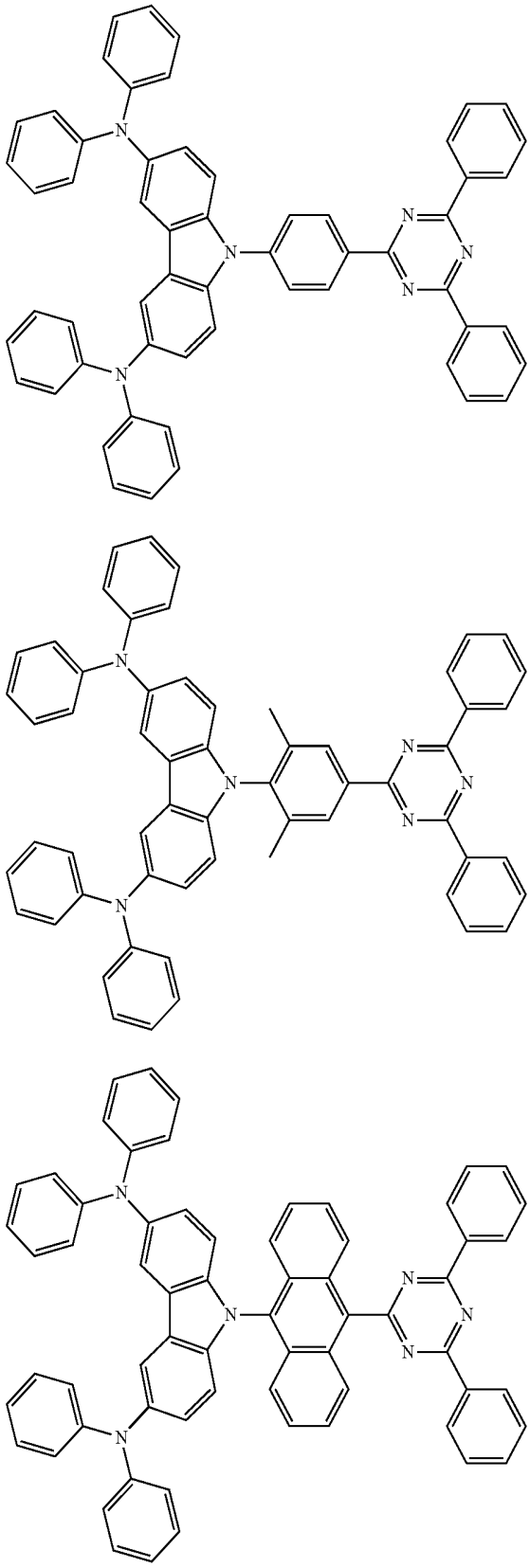


wherein in the general formula (152), R^1 to R^8 and R^{11} to R^{24} each independently represent a hydrogen atom or a substituent, provided that at least one of R^1 to R^9 represents a substituted or unsubstituted diarylamino group, and R^1 and R^2, R^2 and R^3, R^3 and R^4, R^5 and R^6, R^6 and R^7, R^7 and R^8, R^{11} and R^{12}, R^{12} and R^{13}, R^{13} and R^{14}, R^{14} and R^{15}, R^{16} and R^{17}, R^{17} and R^{18}, R^{18} and R^{19}, R^{19} and R^{20}, R^{21} and R^{22}, and R^{23} and R^{24} each may be bonded to each other to form a cyclic structure.

[0131] (8) The compound according to the item (7), wherein in the general formula (192), at least one of R^1 to R^4 represents a substituted or unsubstituted diarylamino group, and at least one of R^5 to R^8 represents a substituted or unsubstituted diarylamino group.

[0132] (9) The compound according to the item (8), wherein in the general formula (192), R^3 and R^6 each represent a substituted or unsubstituted diarylamino group.

[0133] Specific examples of the compound include the following compounds. Ph represents a phenyl group.



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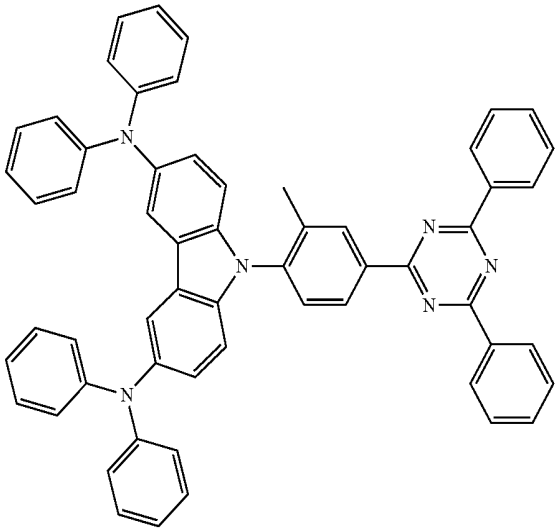

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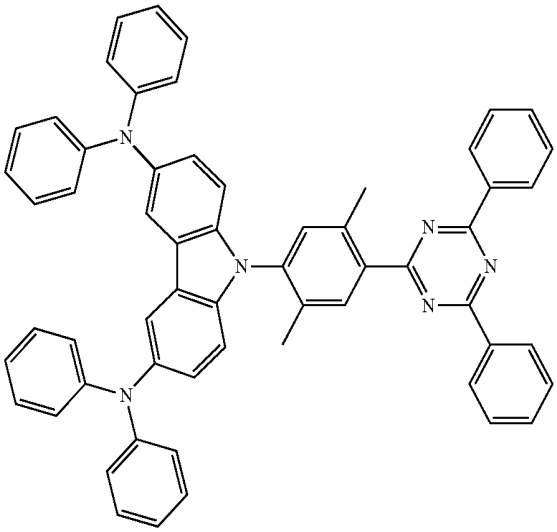

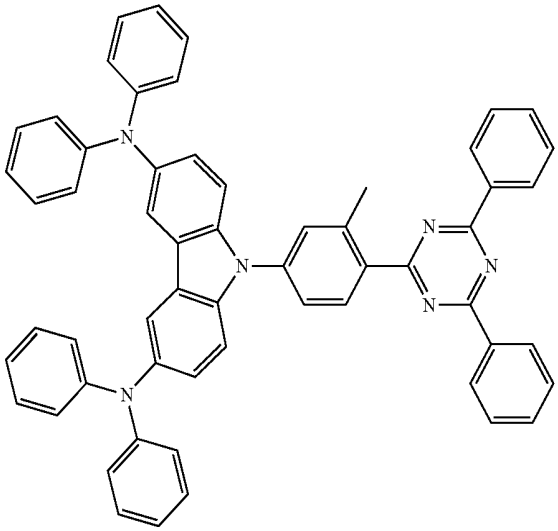

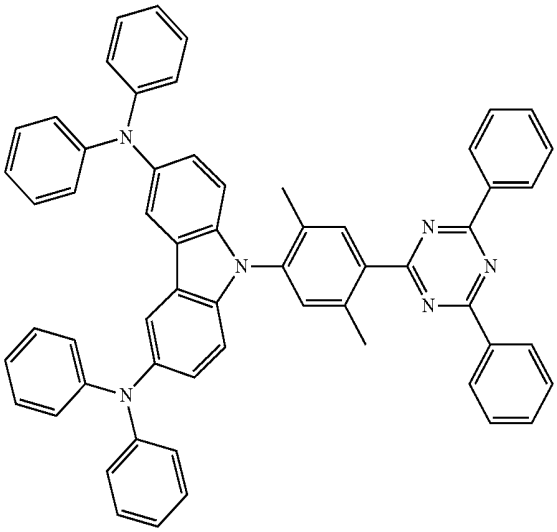

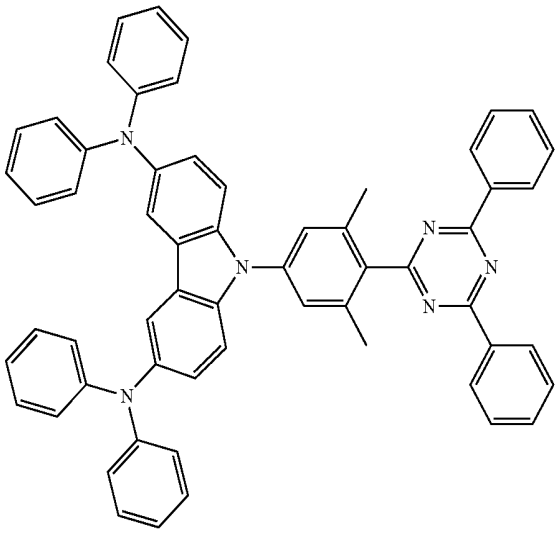

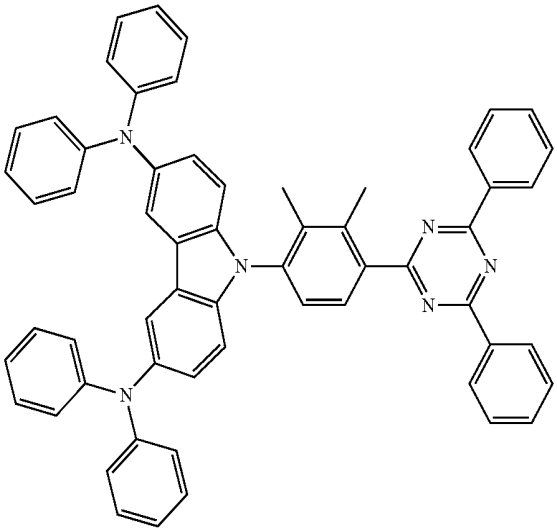

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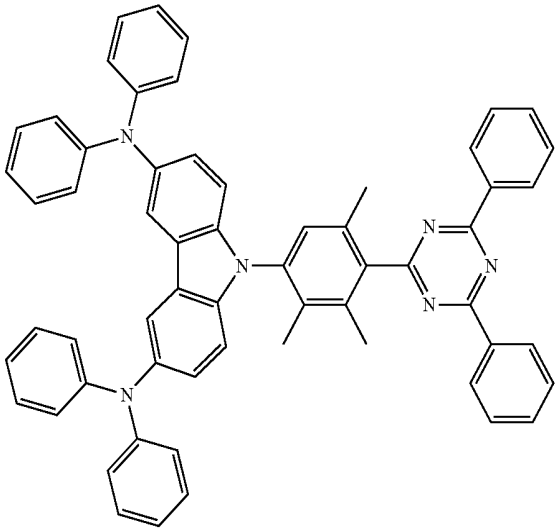
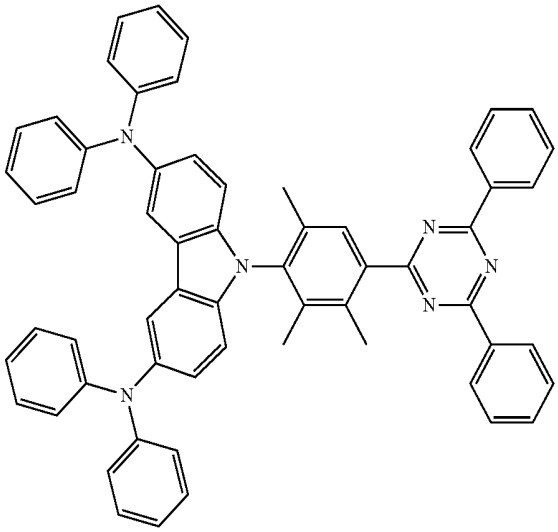
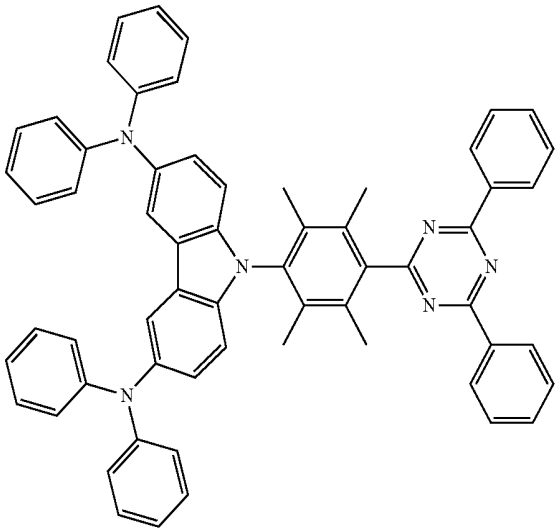


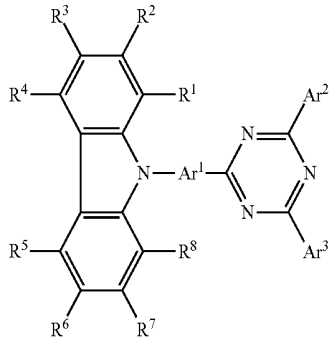




[0134] Examples of the preferred light-emitting material include the following compounds.

[0135] (1) A compound represented by the following general formula (201):

General Formula (201)



wherein in the general formula (201), R^1 to R^8 each independently represent a hydrogen atom or a substituent, provided that at least one of R^1 to R^8 represents a substituted or unsubstituted carbazolyl group; and Ar^1 to Ar^3 each independently represent a substituted or unsubstituted aromatic ring or a heteroaromatic ring.

[0136] (2) The compound according to the item (3), wherein in the general formula (201), at least one of R^3 and R^6 represents a substituted or unsubstituted carbazolyl group.

[0137] (3) The compound according to the item (1) ox (2), wherein the carbazolyl group is a 1-carbazolyl group, a 2-carbazolyl group, a 3-carbazolyl group or a 4-carbazolyl group.

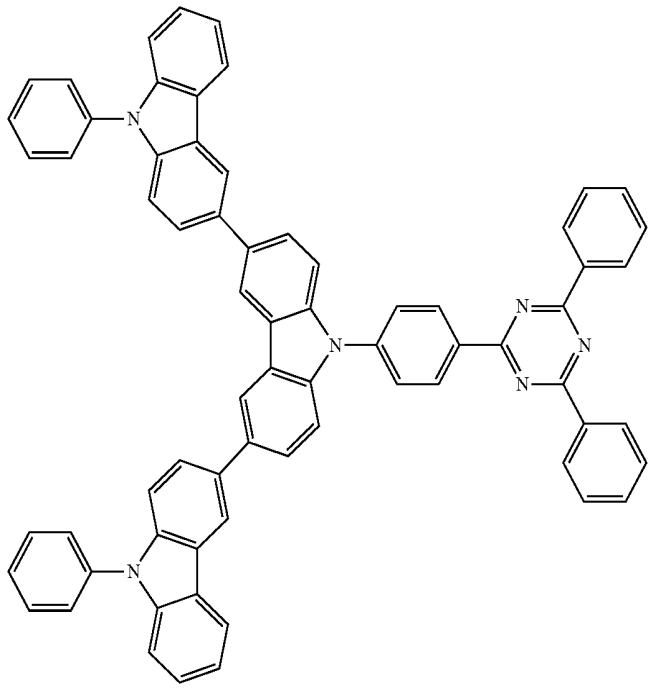
[0138] (4) The compound according to any one of the items (1) to (3), wherein the carbazolyl group has a substituent on the nitrogen atom in the carbazole ring structure.

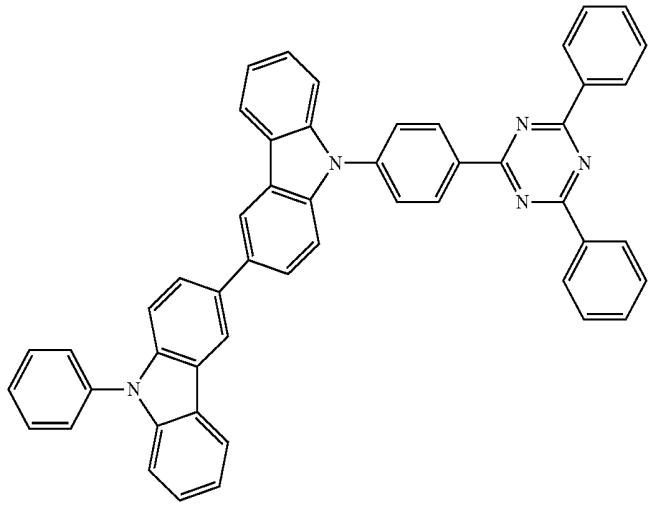
[0139] (5) The compound according to any one of the items (1) to (4), wherein in the general formula (201), at least one of Ar^1, Ar^2 and Ar^3 represents a benzene ring or a naphthalene ring.

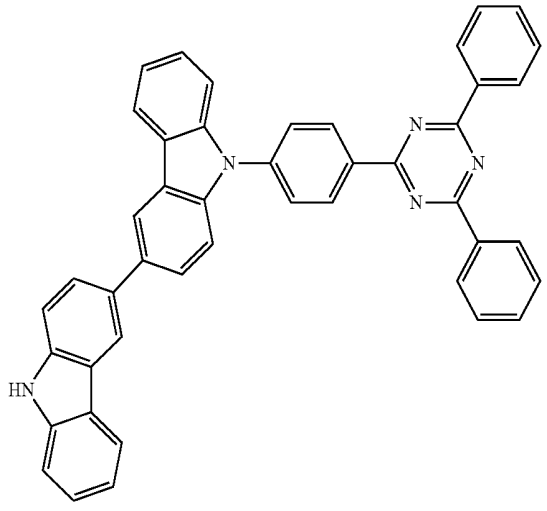
[0140] (6) The compound according to any one of the items (1) to (5), wherein in the general formula (201), Ar^1, Ar^2 and Ar^3 each represent the same aromatic ring or the same heteroaromatic ring.

[0141] (7) The compound according to any one of the items (1) to (6), wherein in the general formula (201), Ar^1, Ar^2 and Ar^3 each represent a benzene ring.

[0142] Specific examples of the compound include the following compounds.







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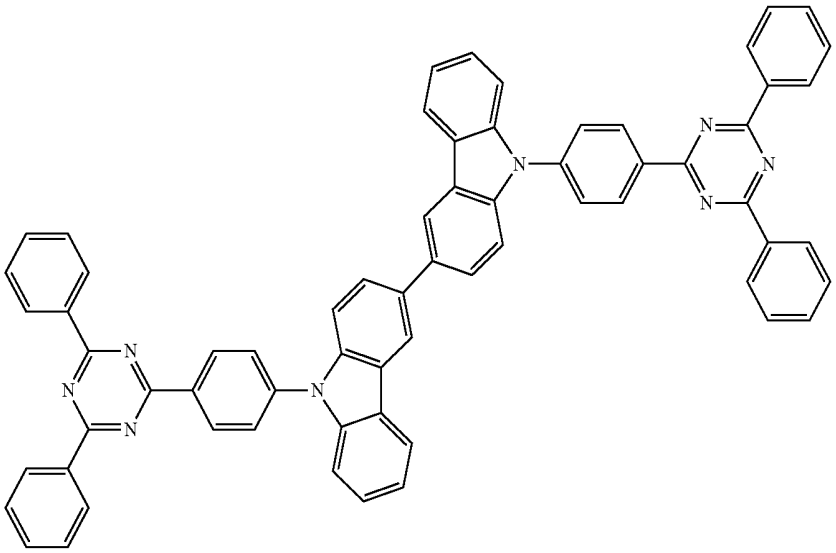

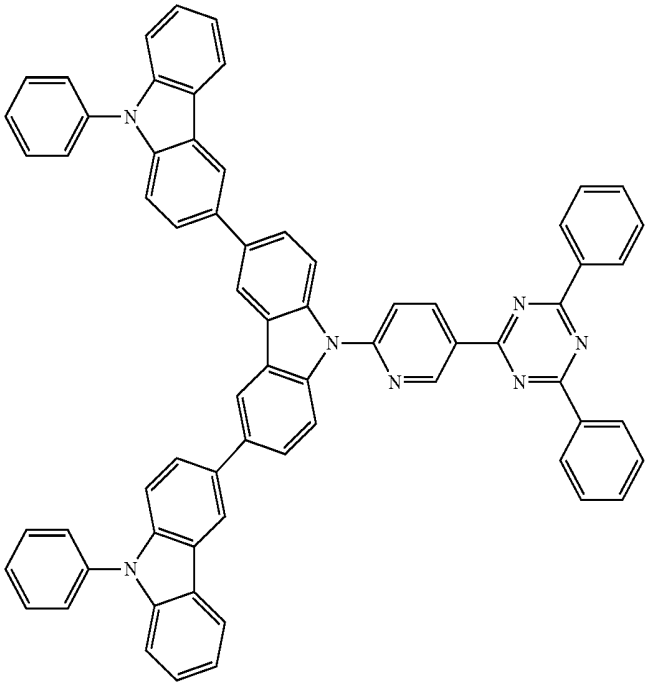

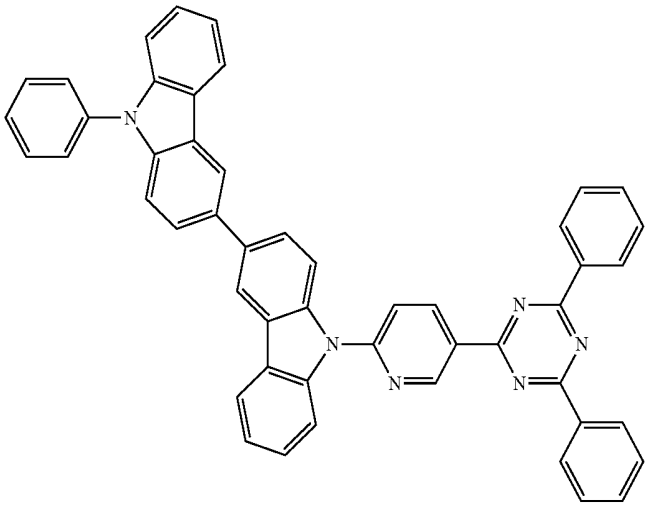

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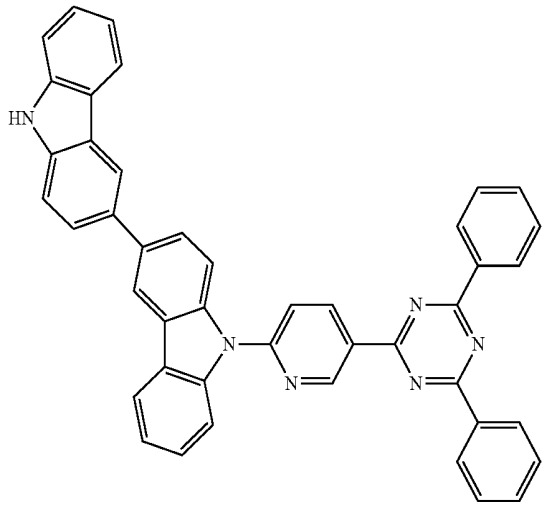

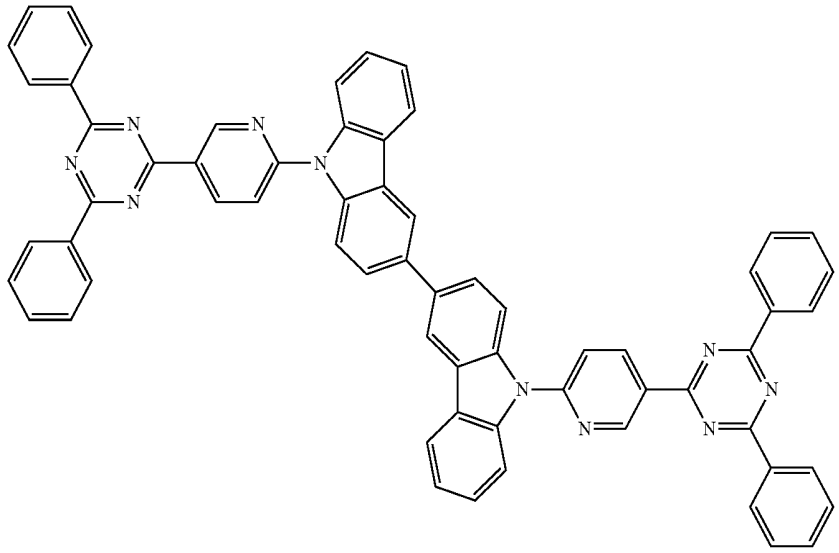

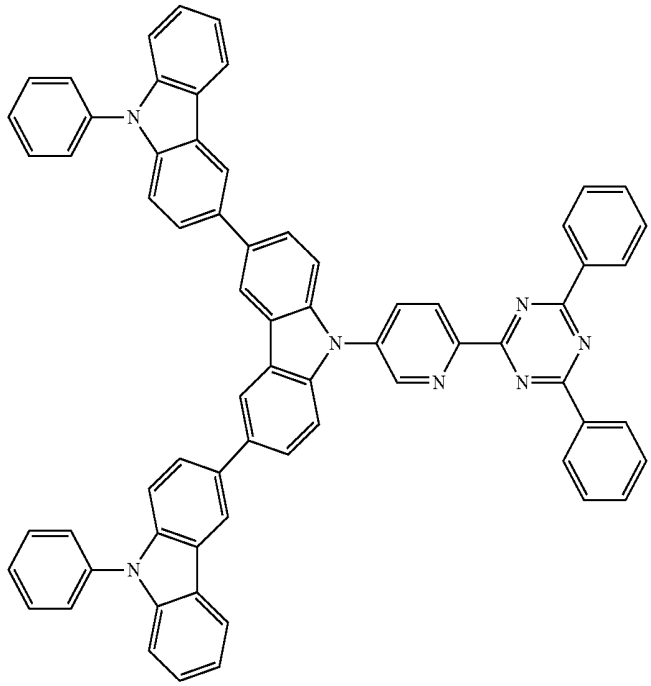

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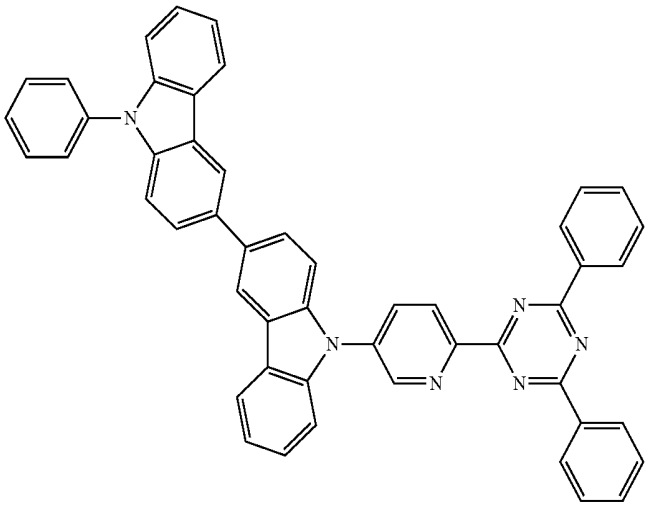

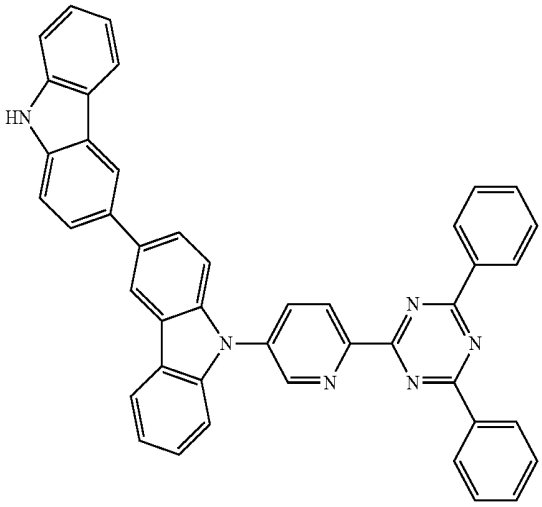

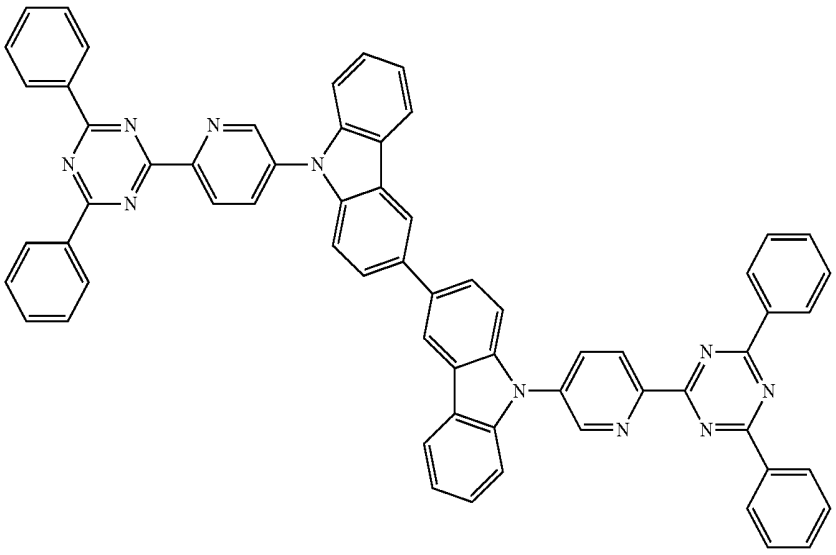

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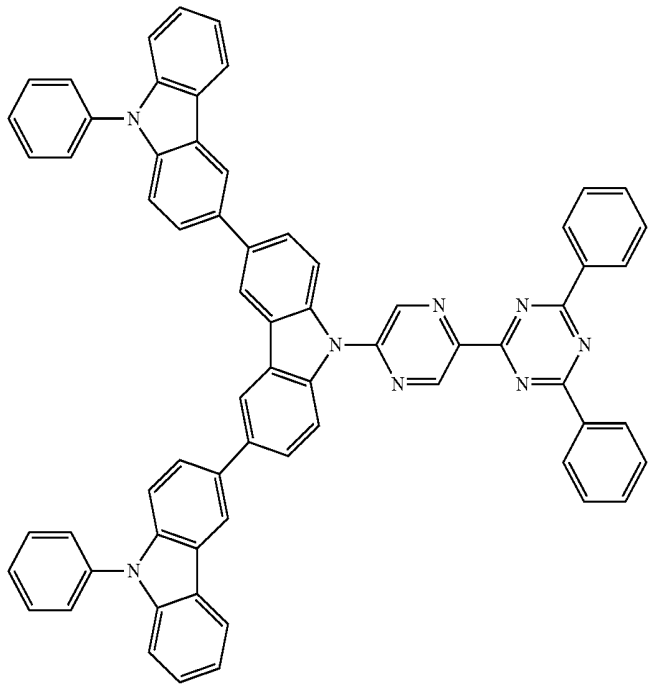

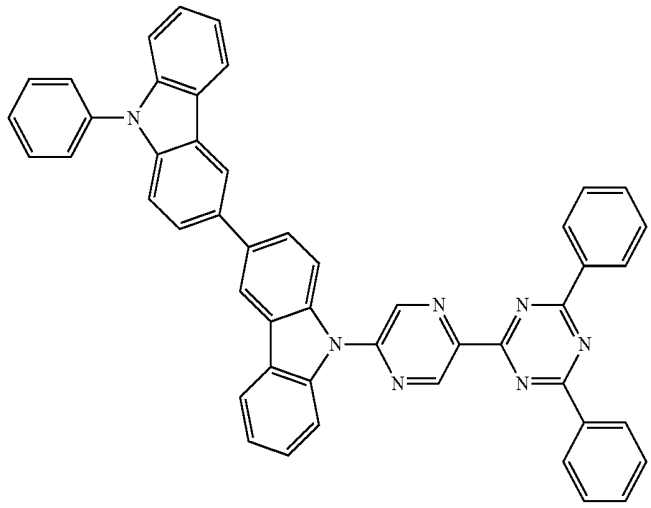

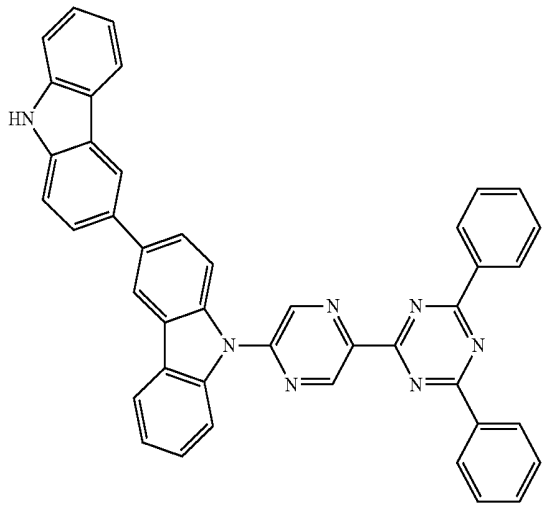

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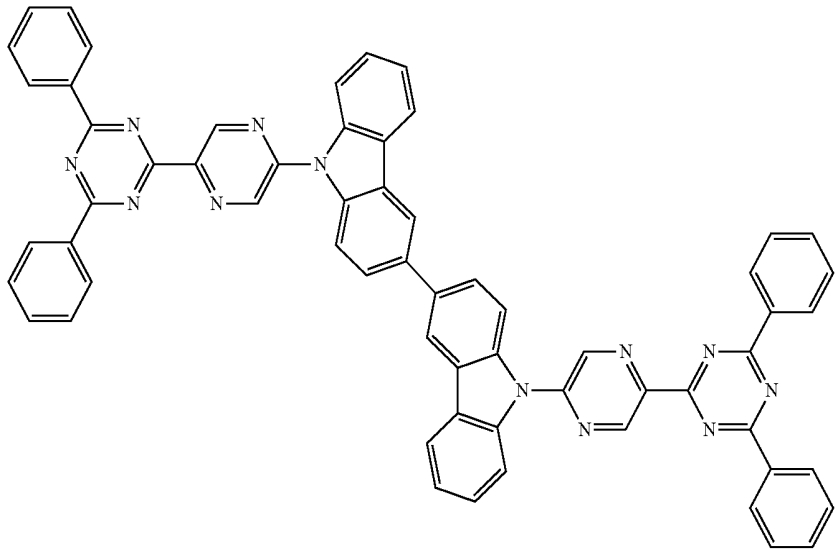

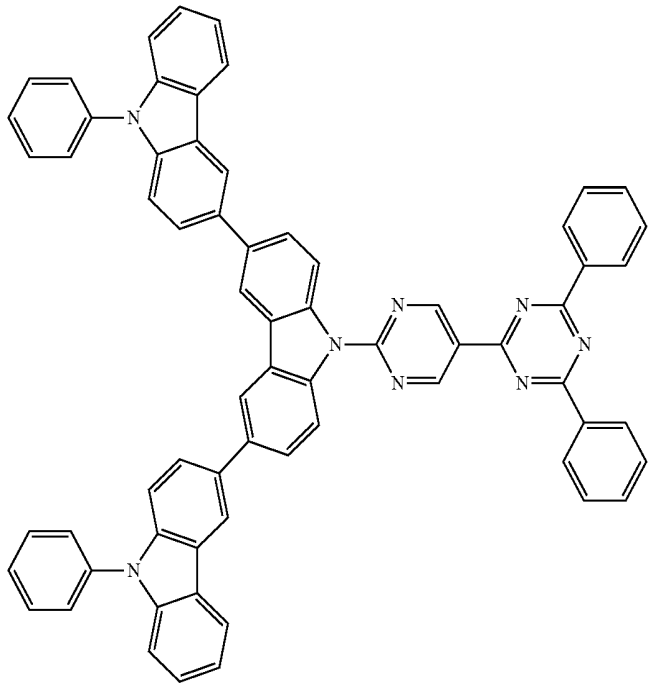

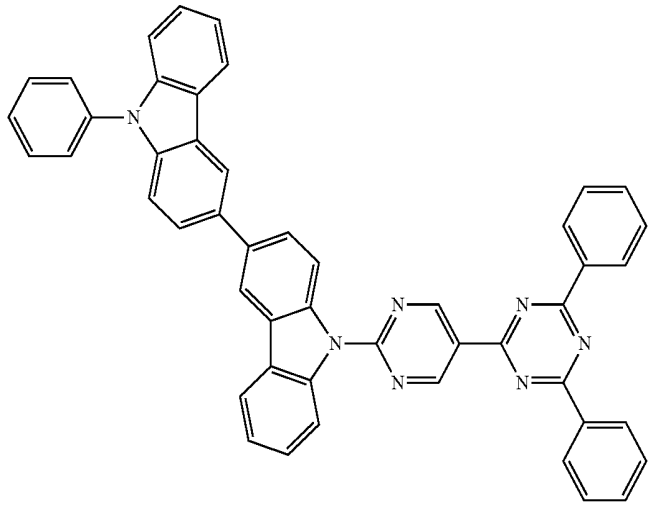

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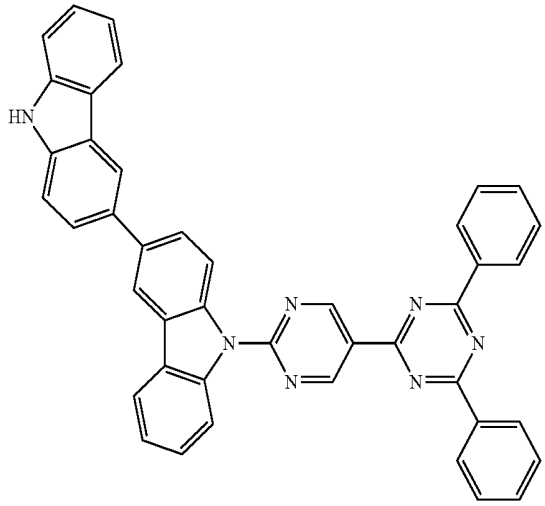

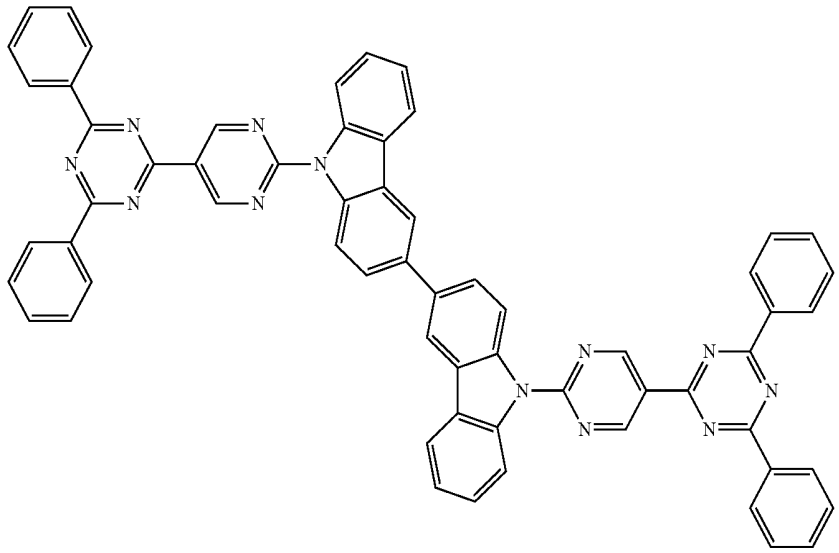

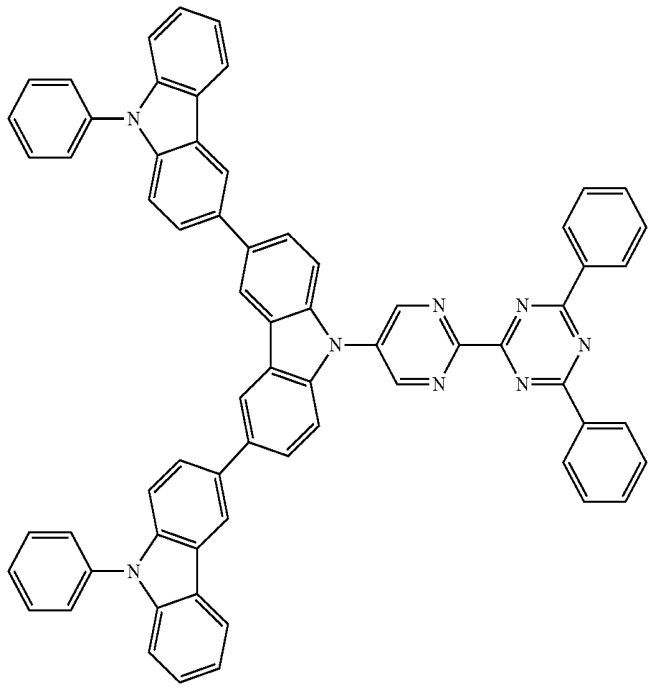

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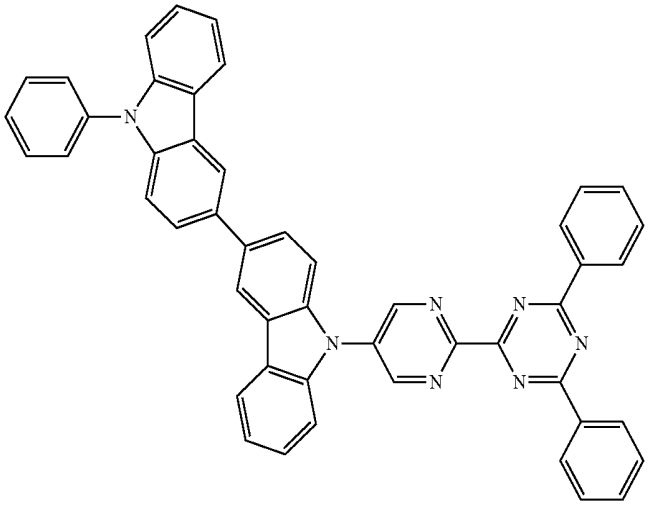

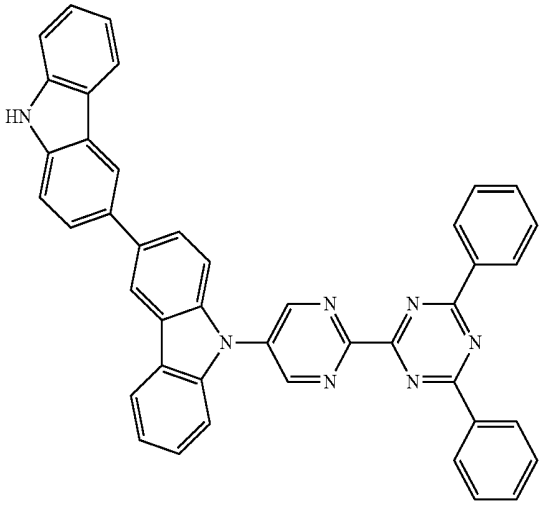

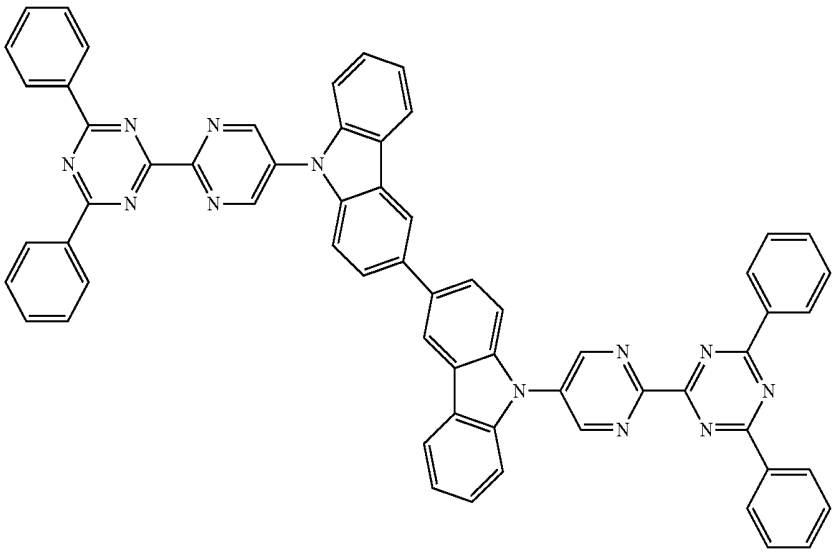

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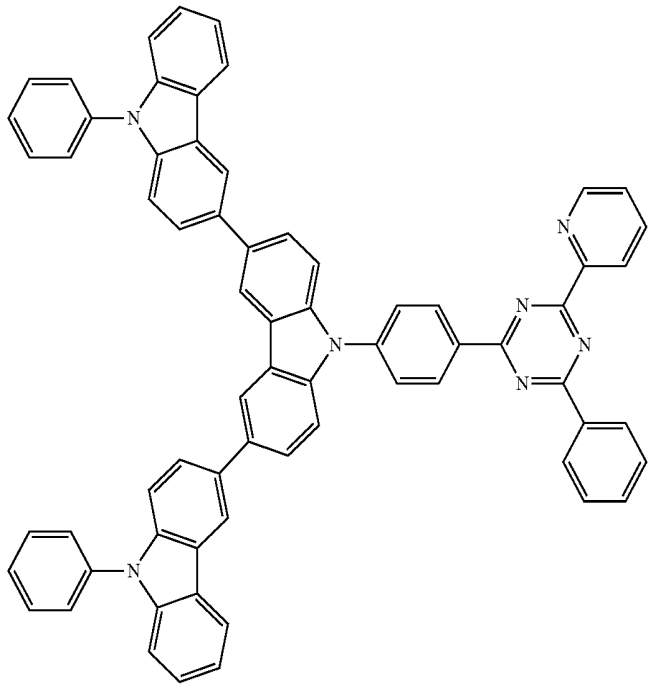

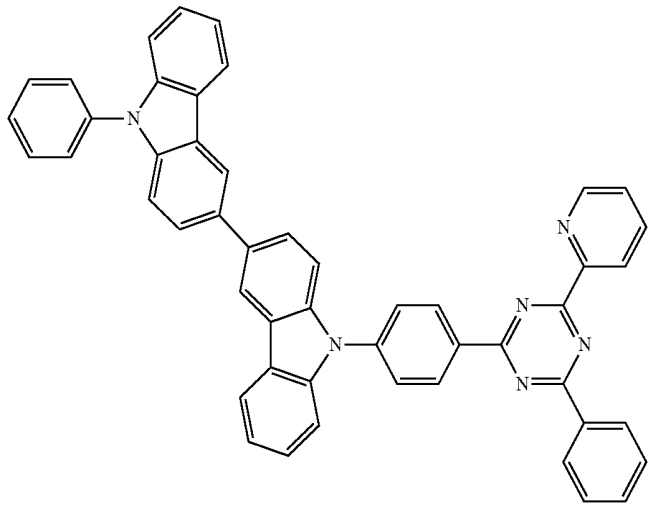

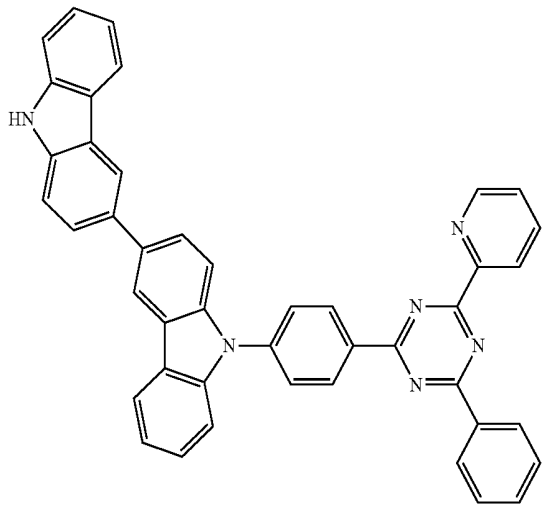

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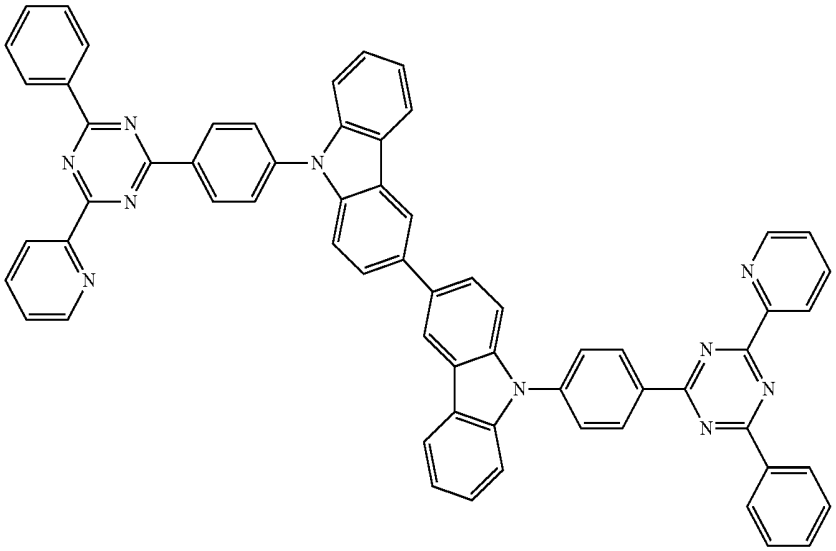

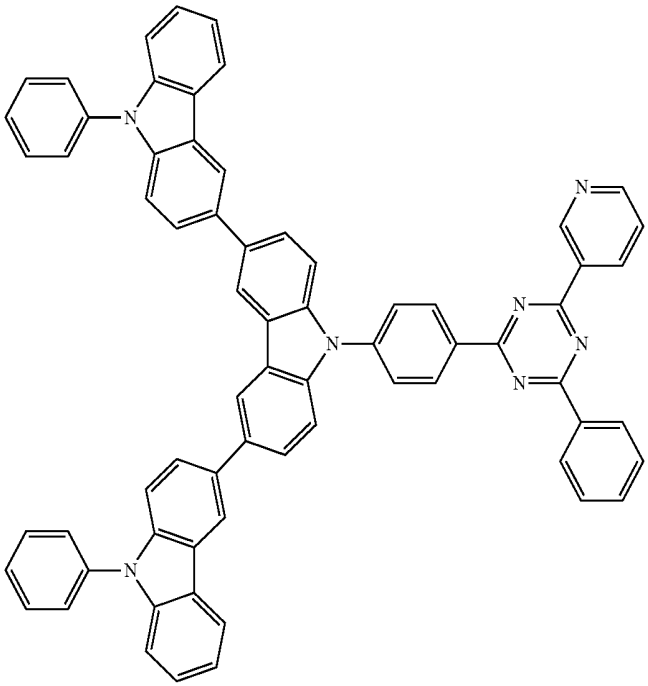

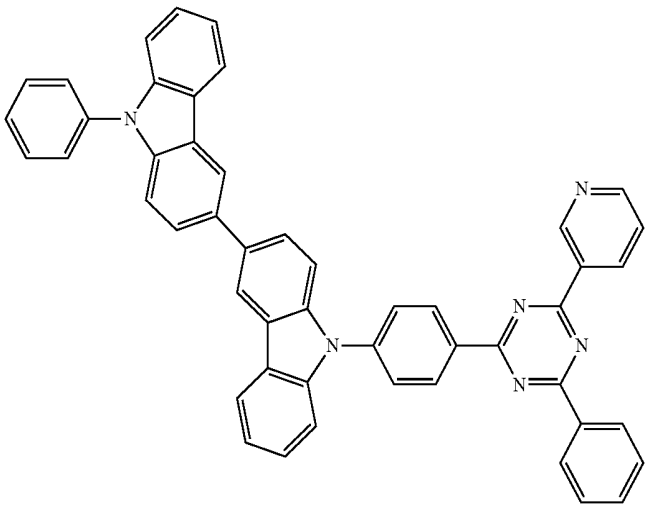

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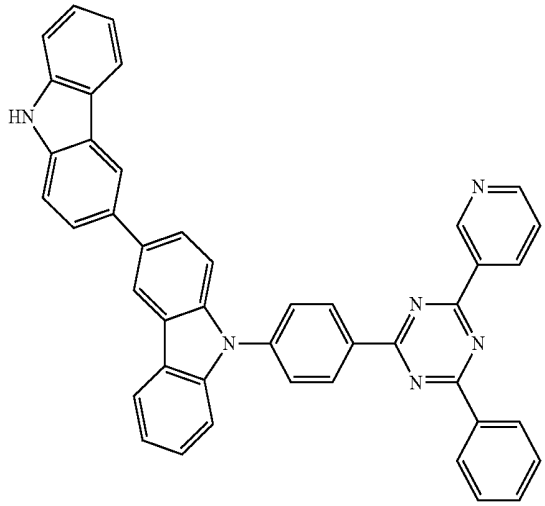

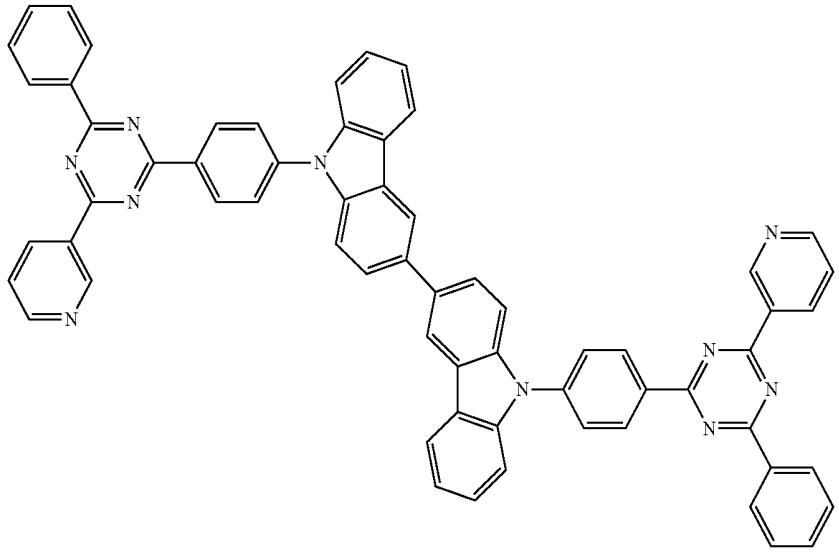

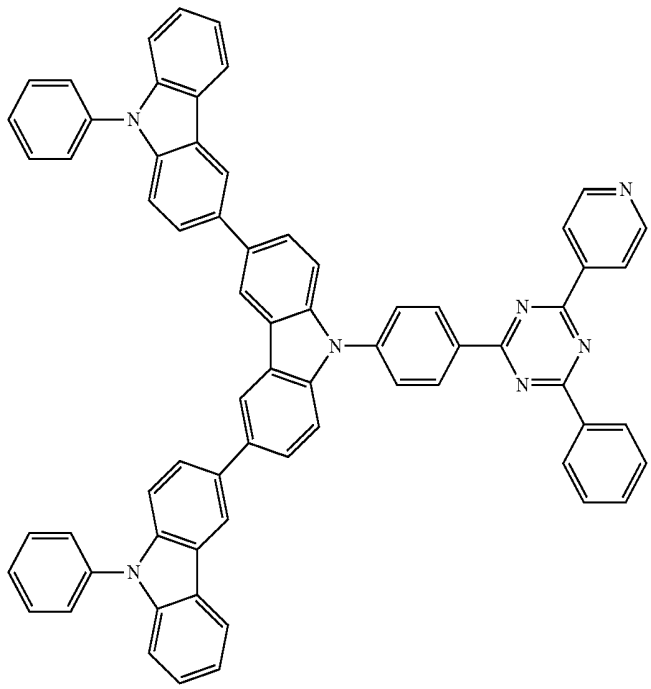

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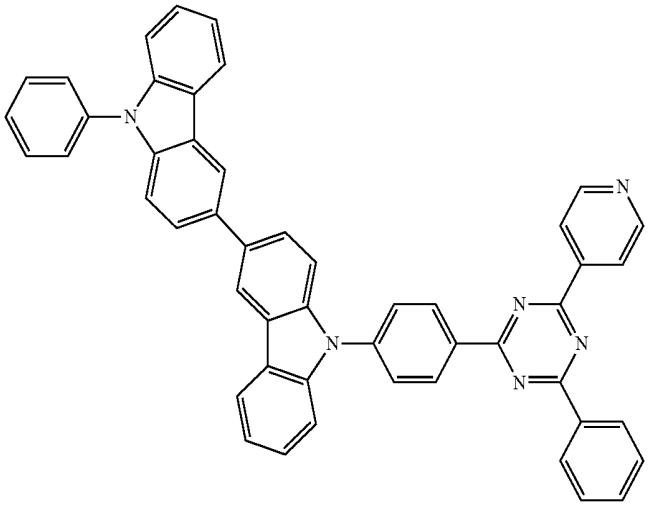

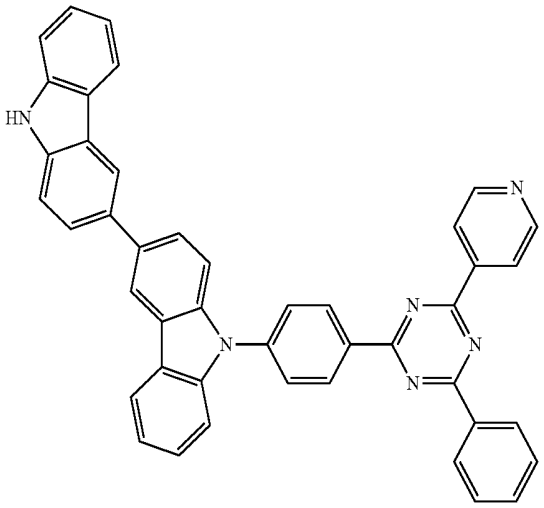

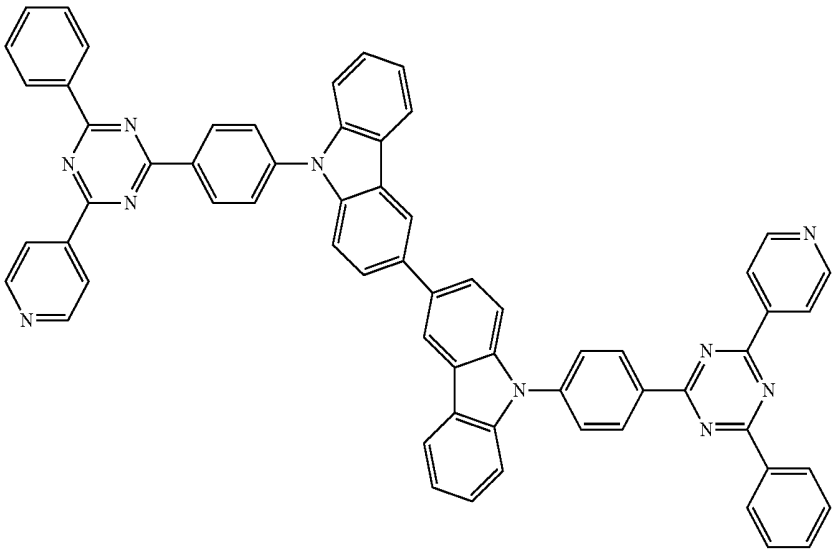

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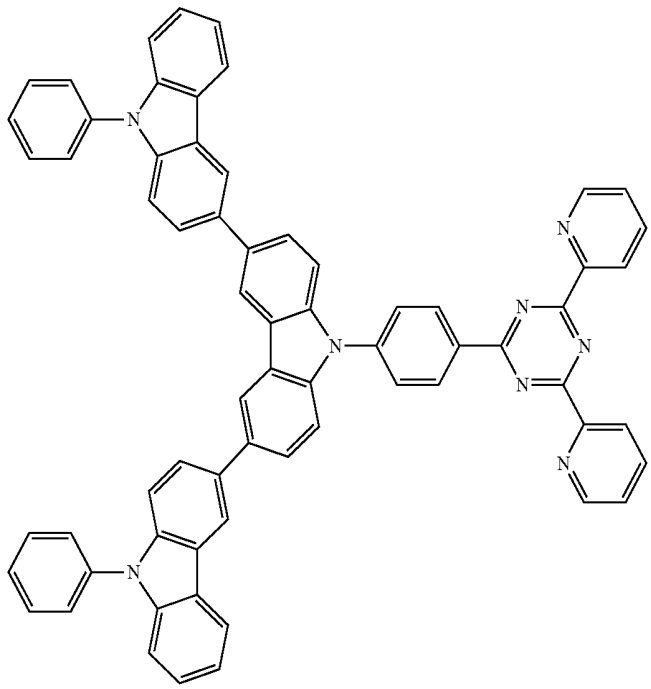

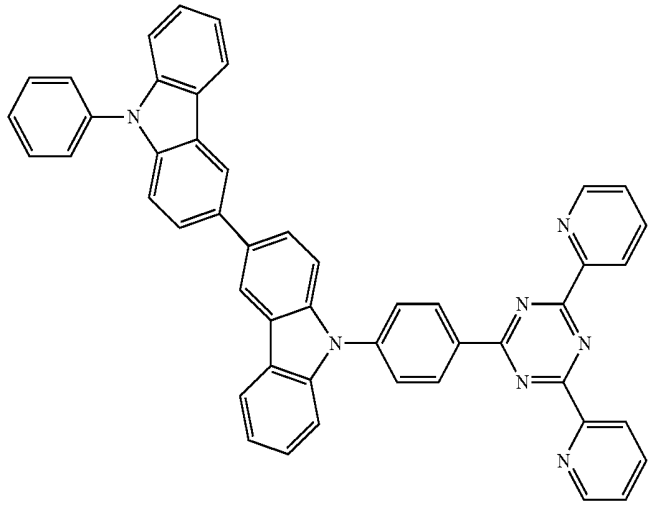

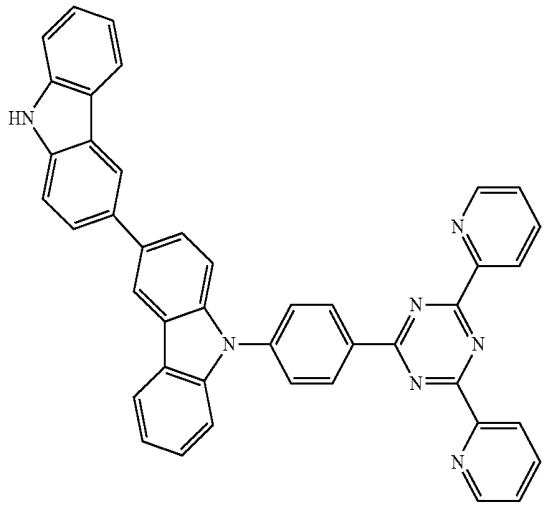

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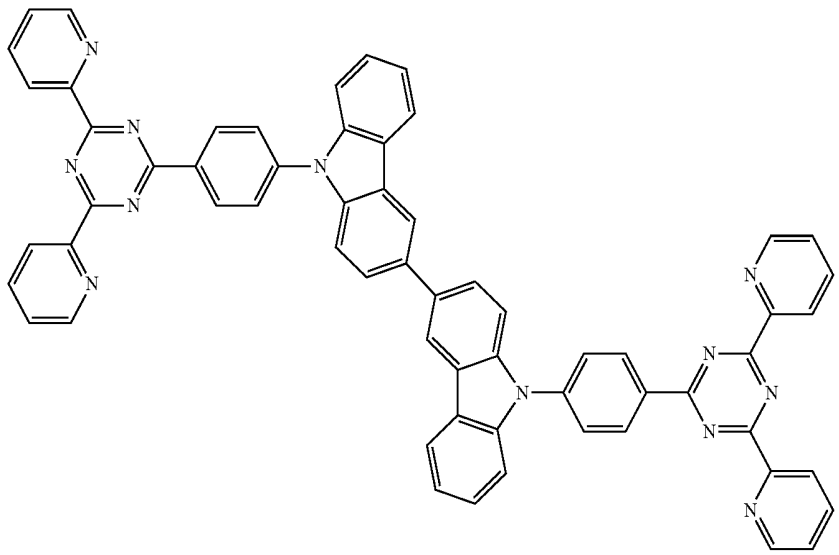

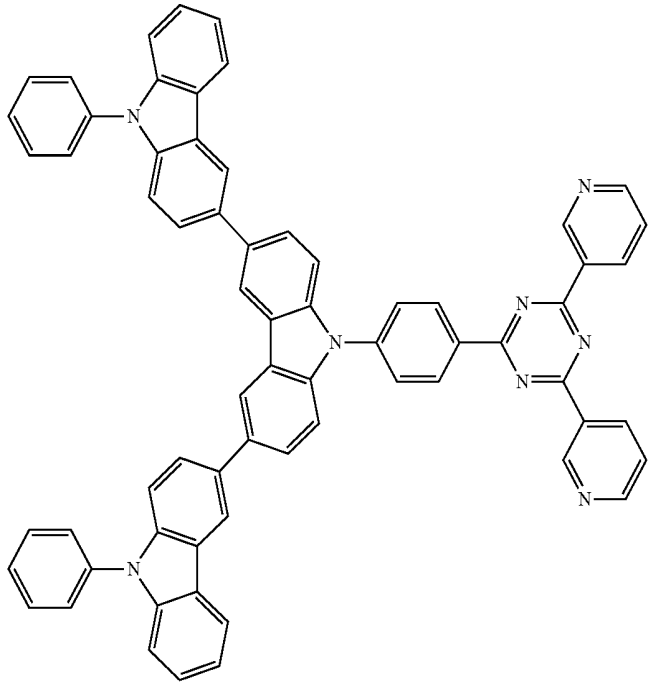

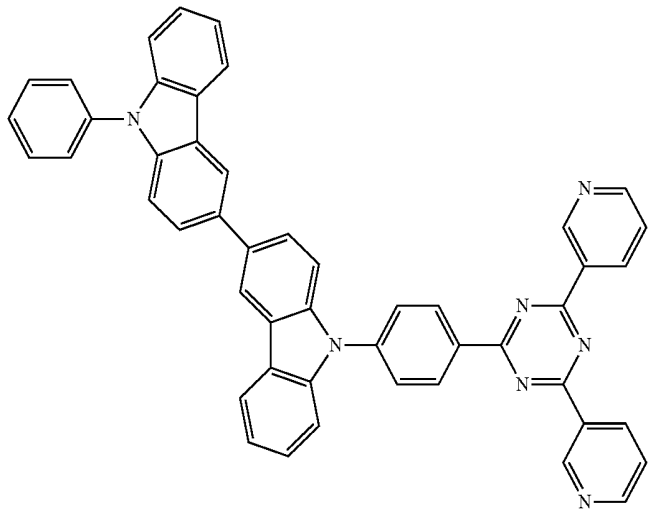

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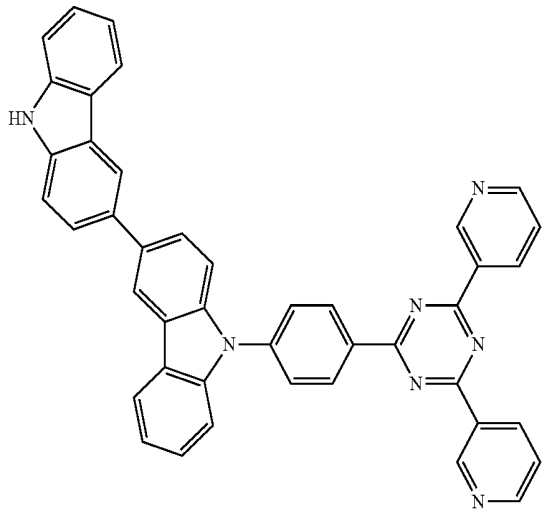

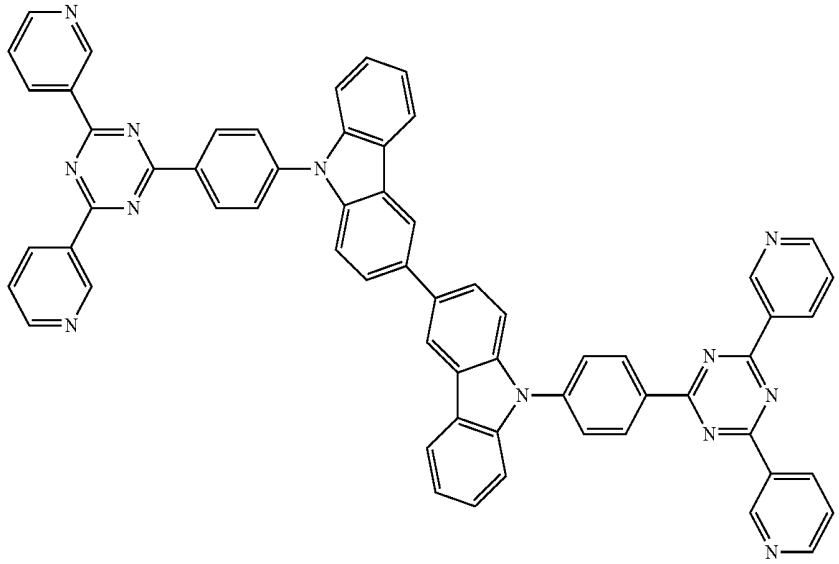

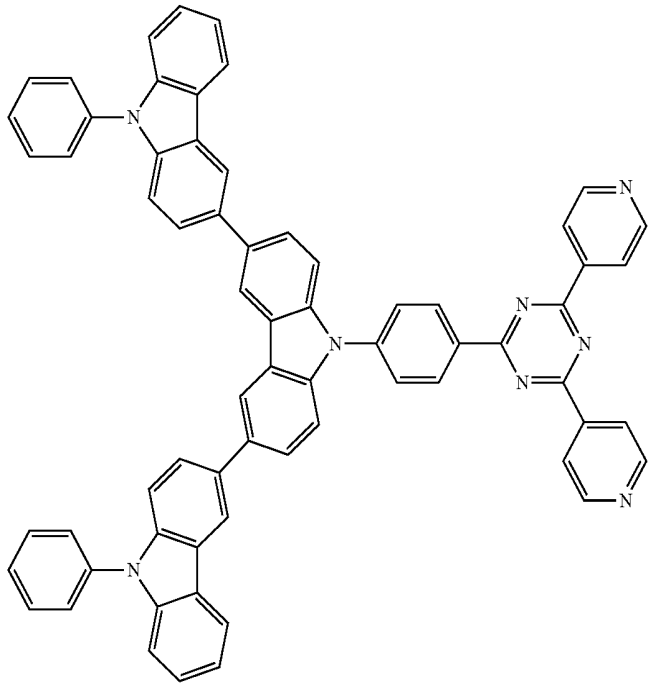

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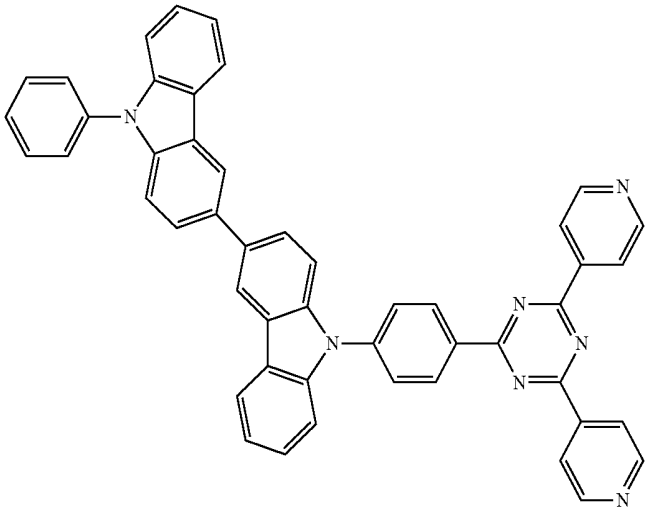

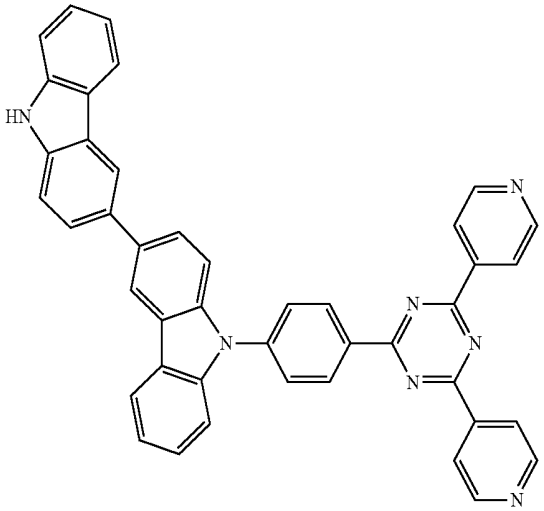

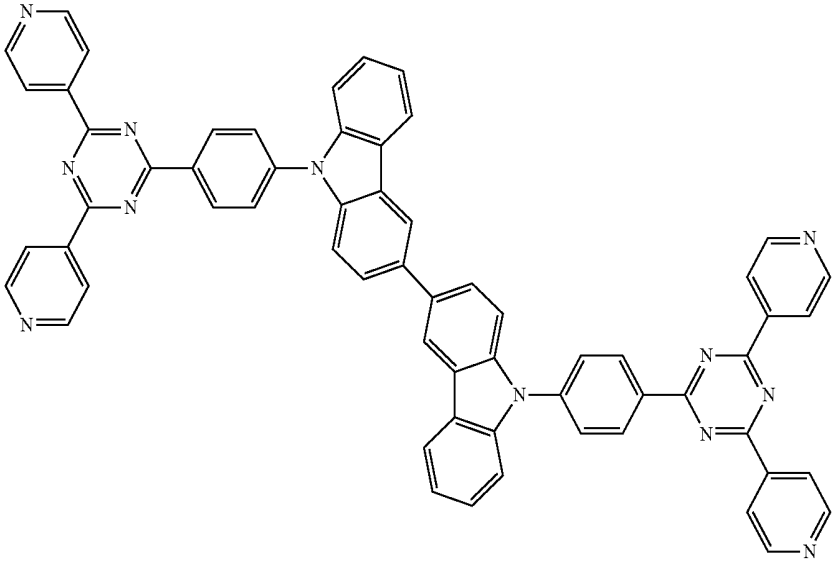

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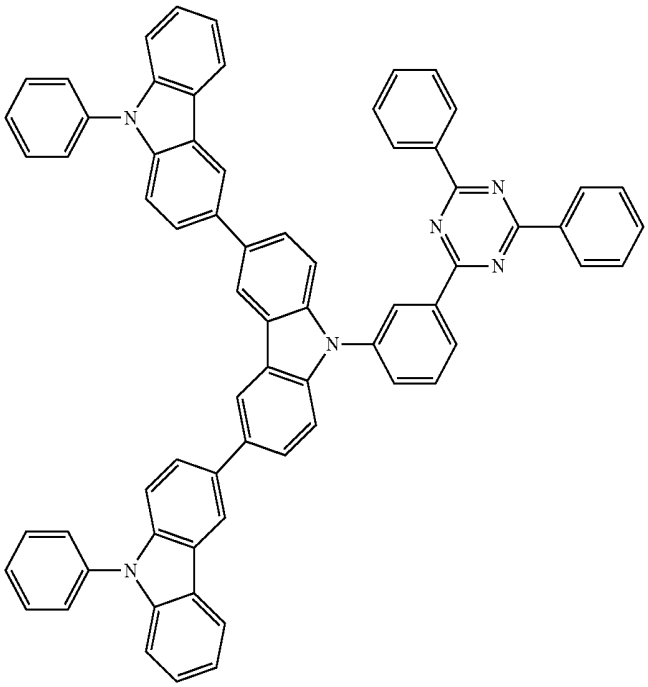

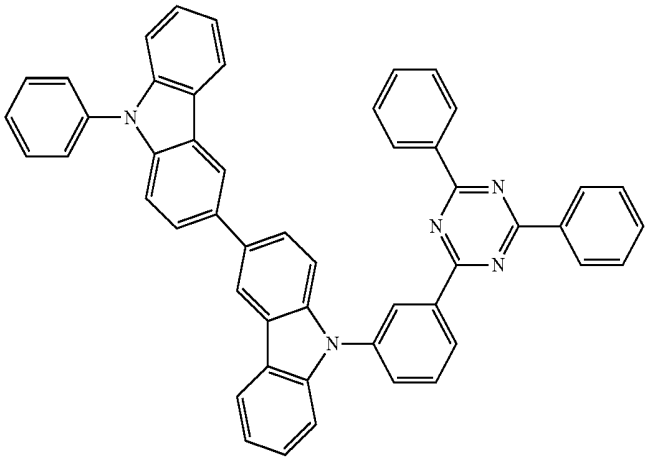

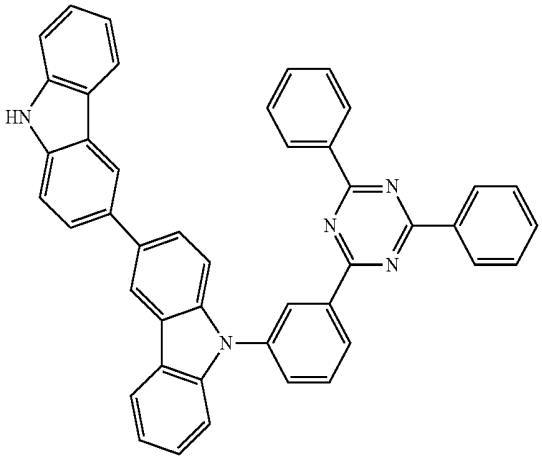

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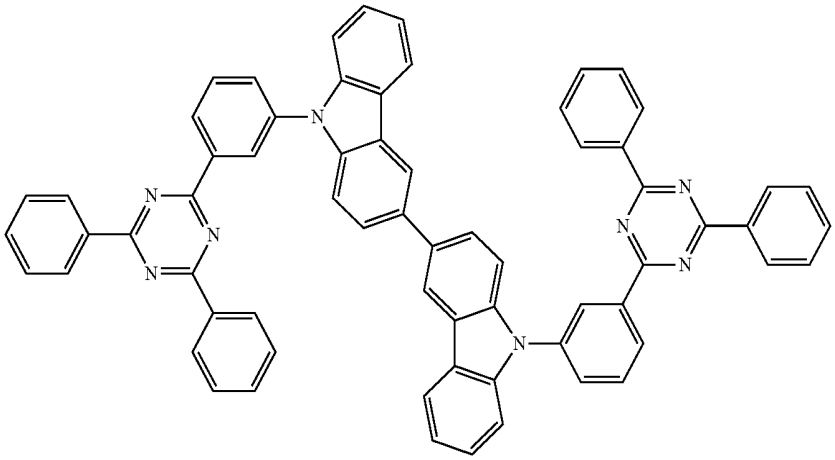

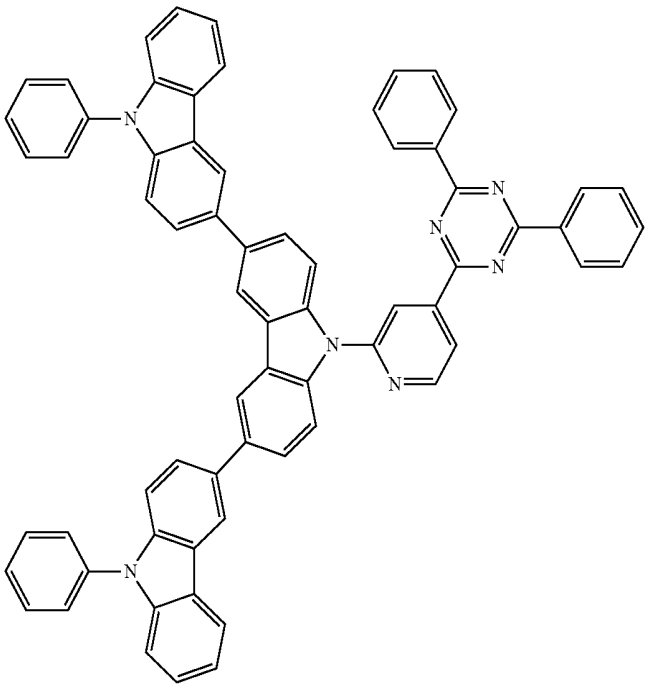

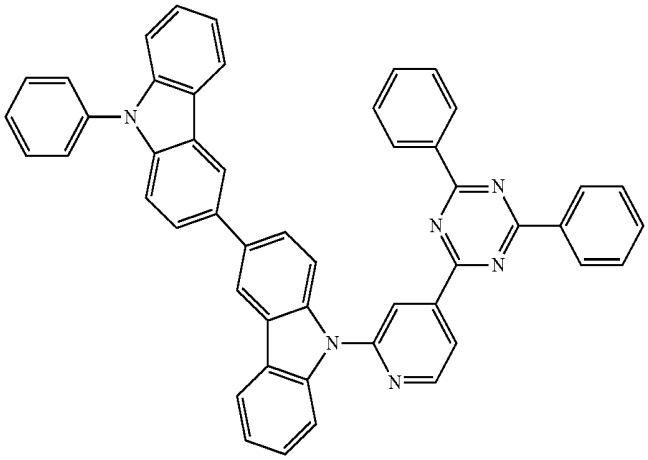

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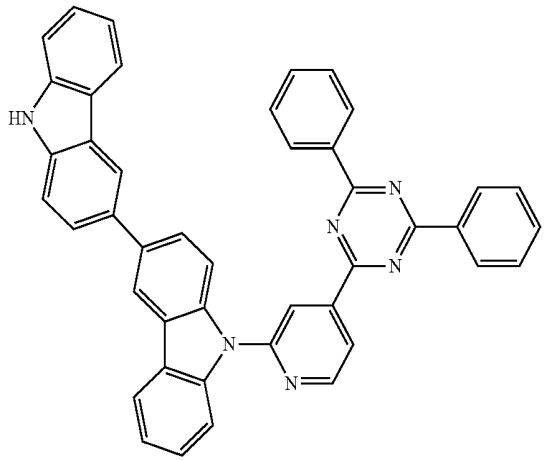

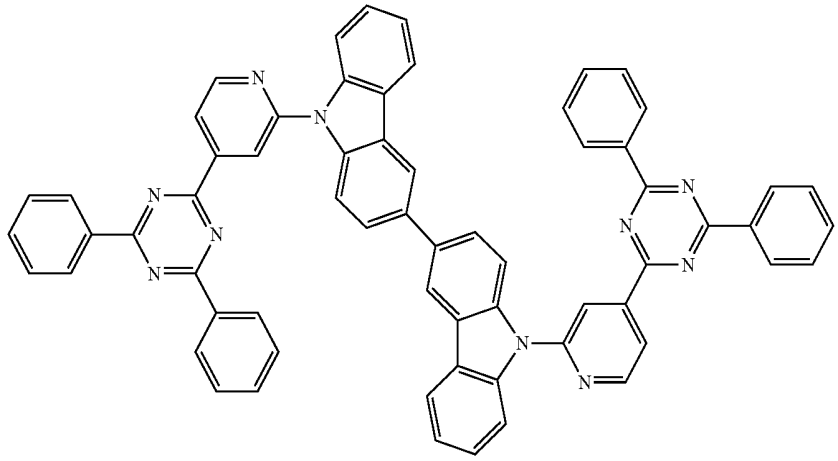

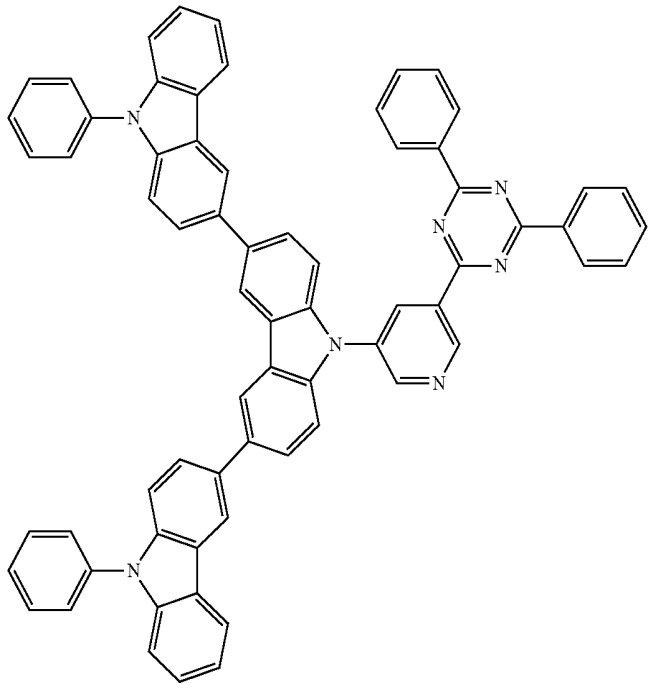

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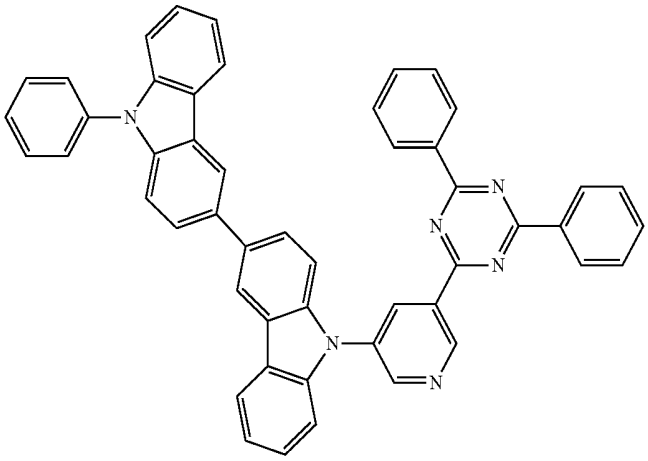

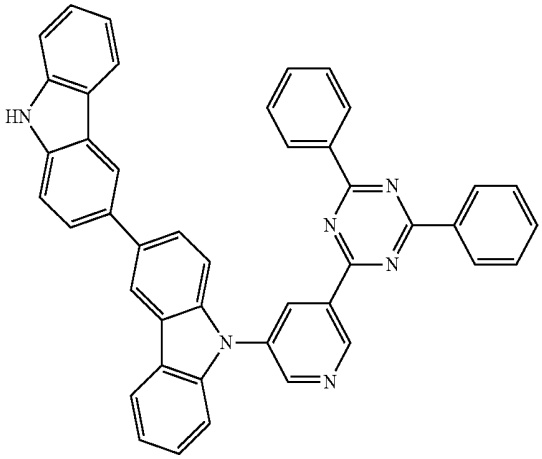

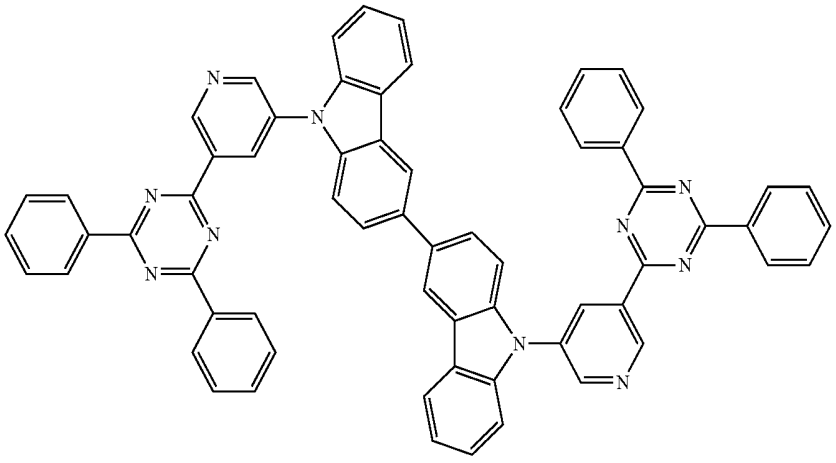

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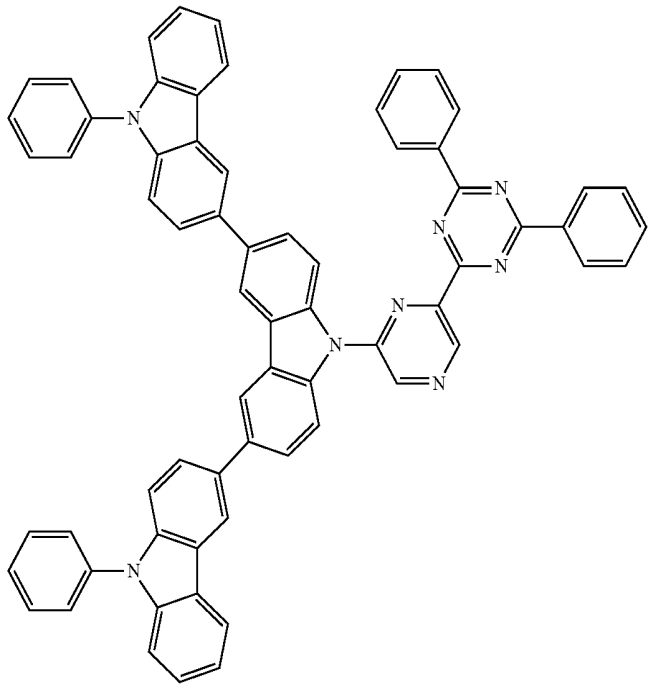

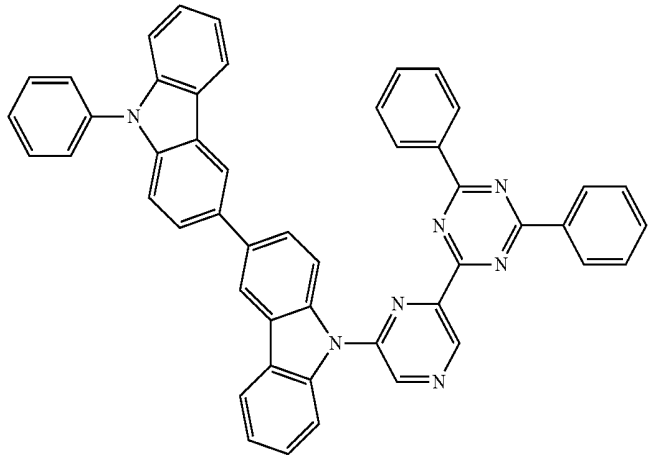

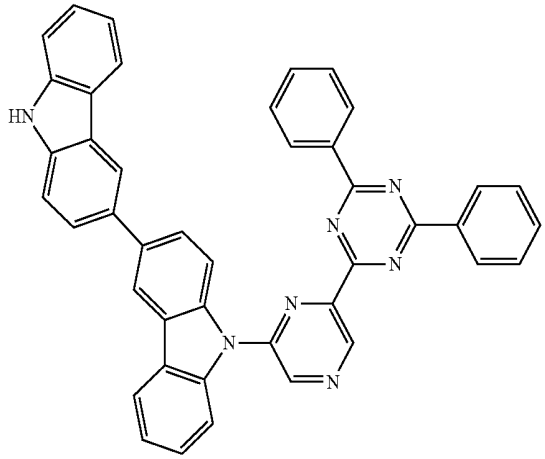

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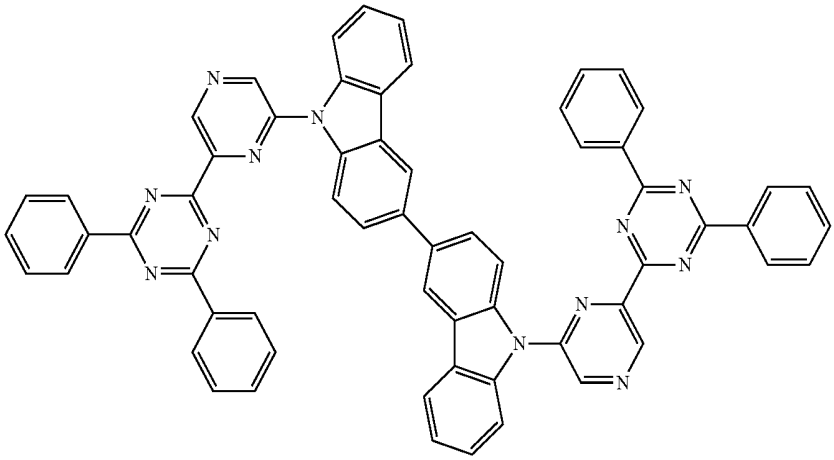

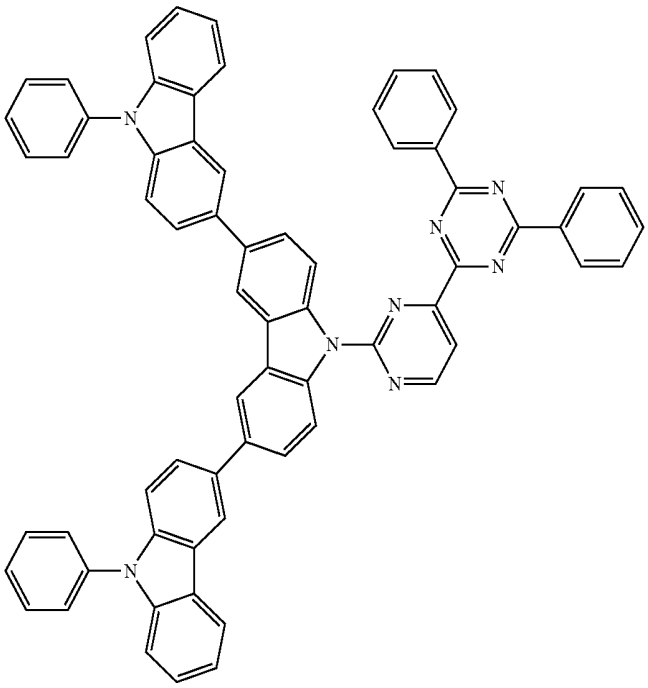

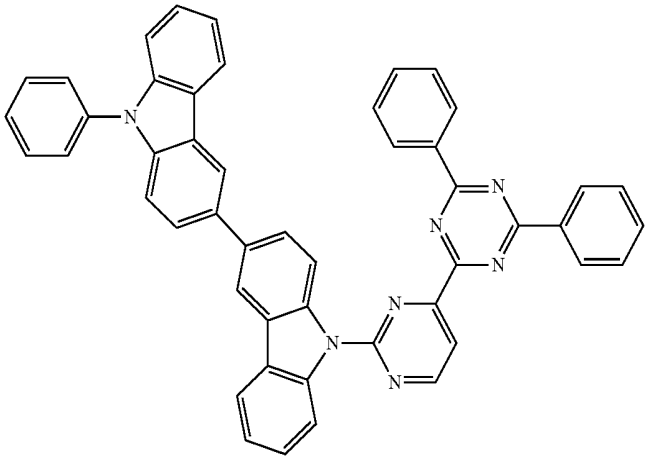

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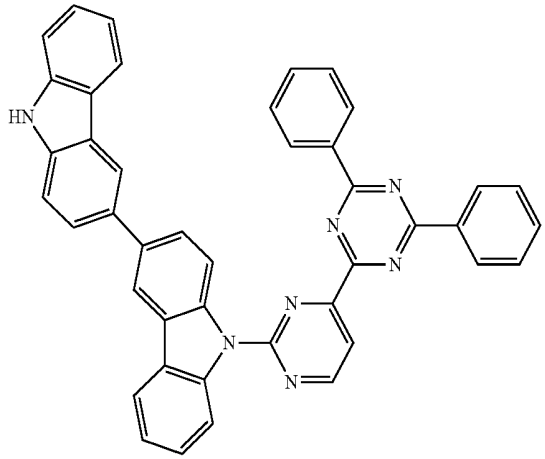

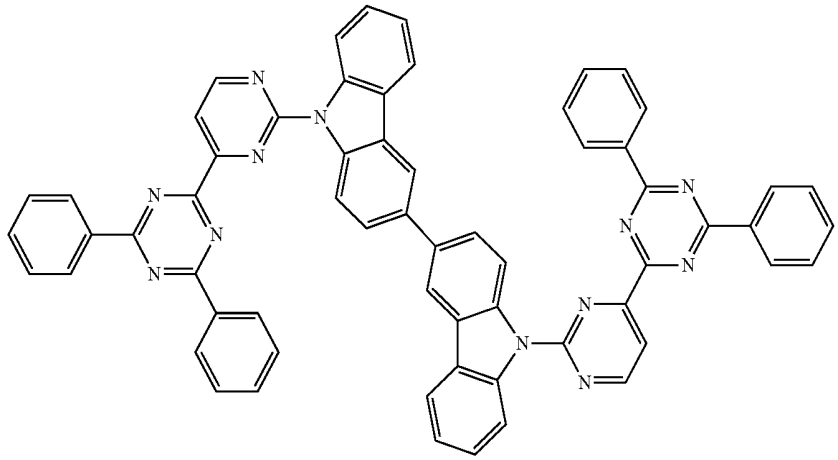

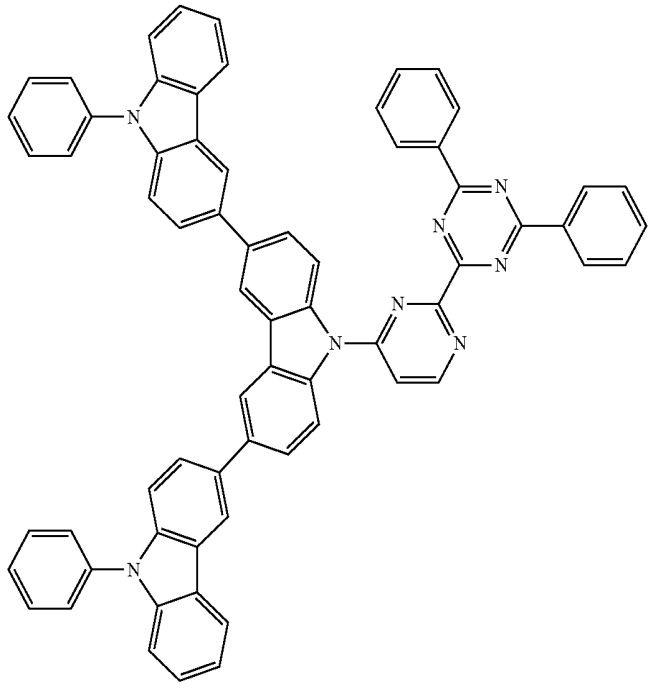

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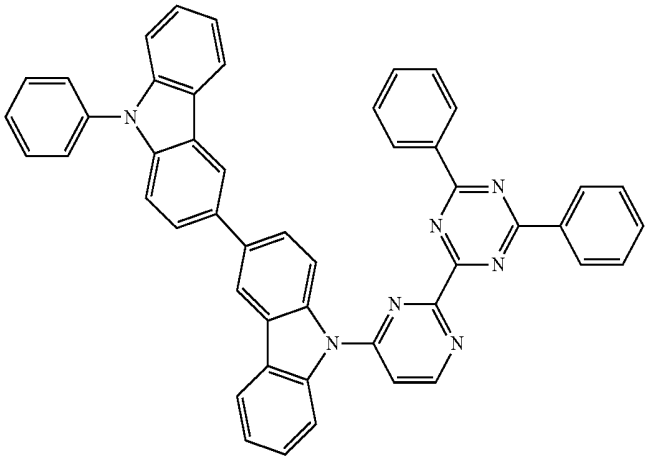

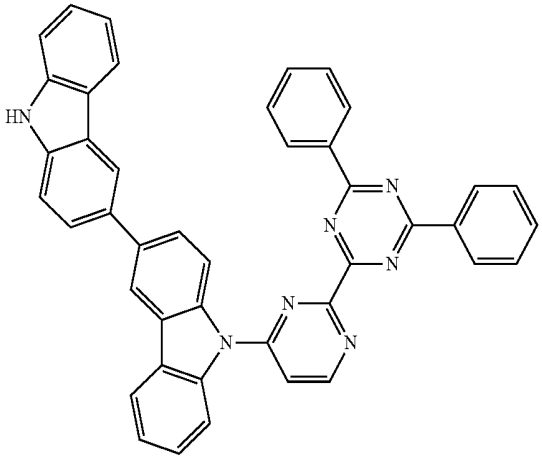

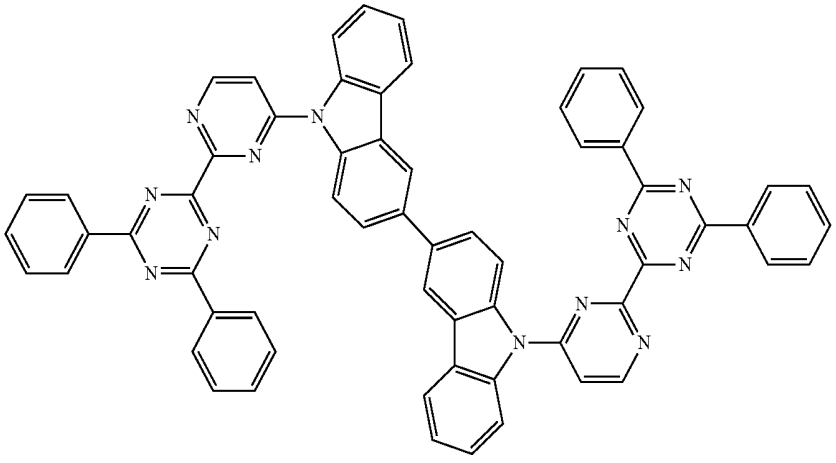

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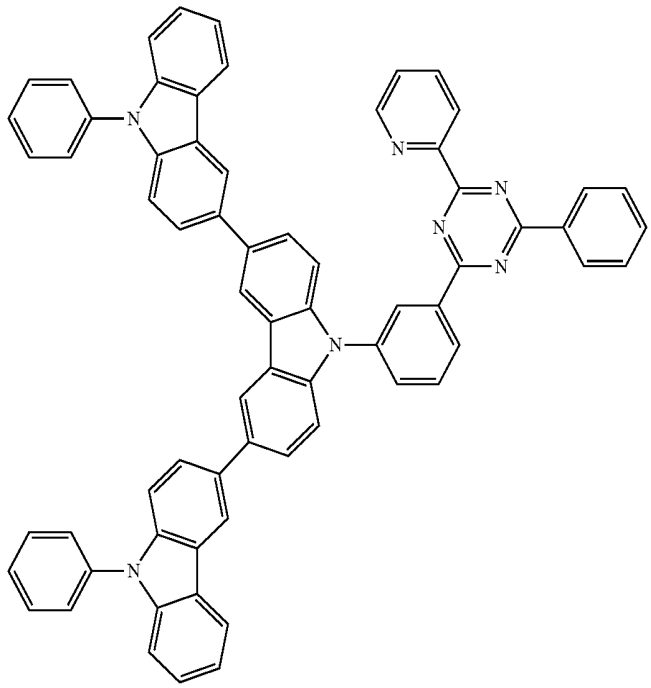

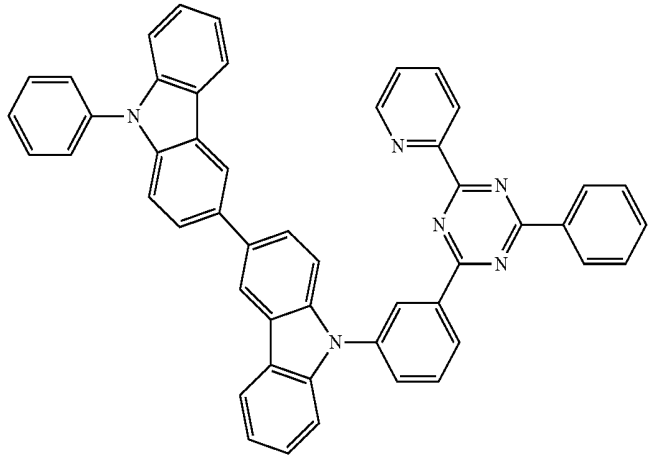

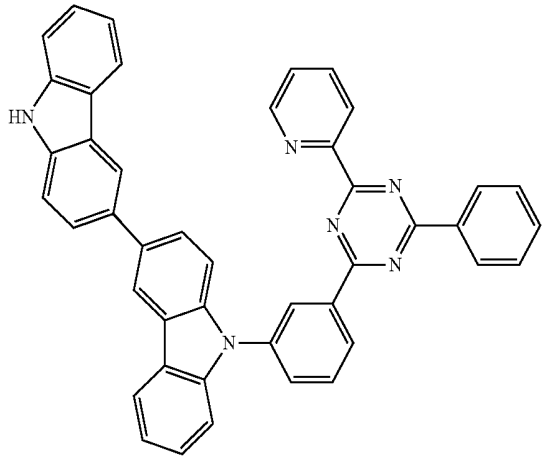

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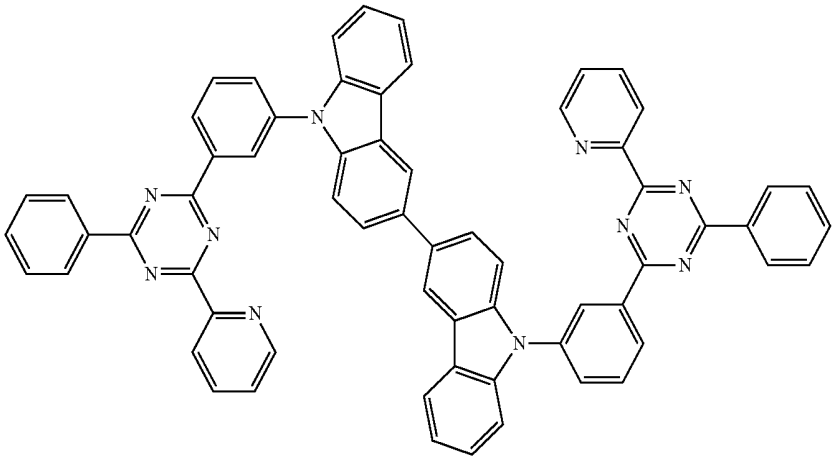

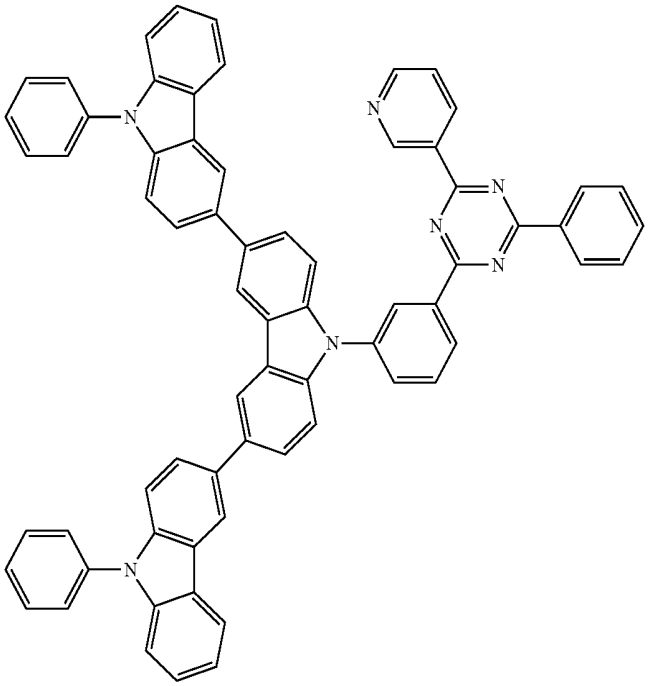

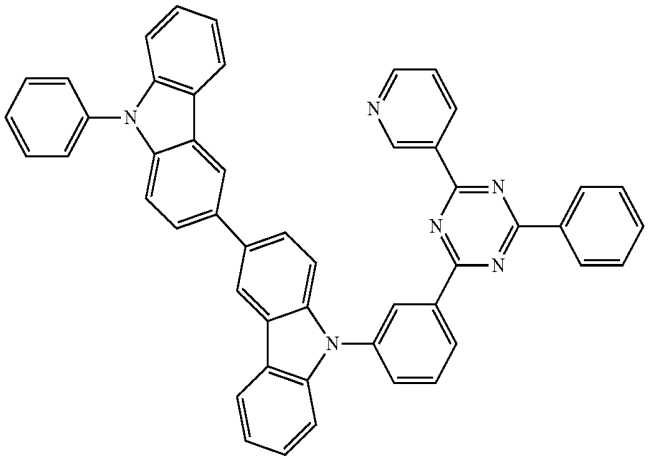

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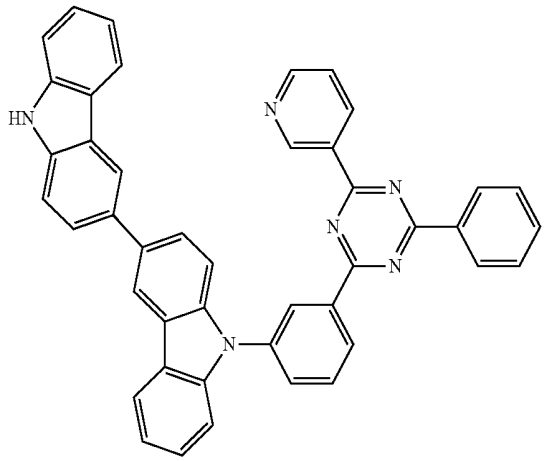

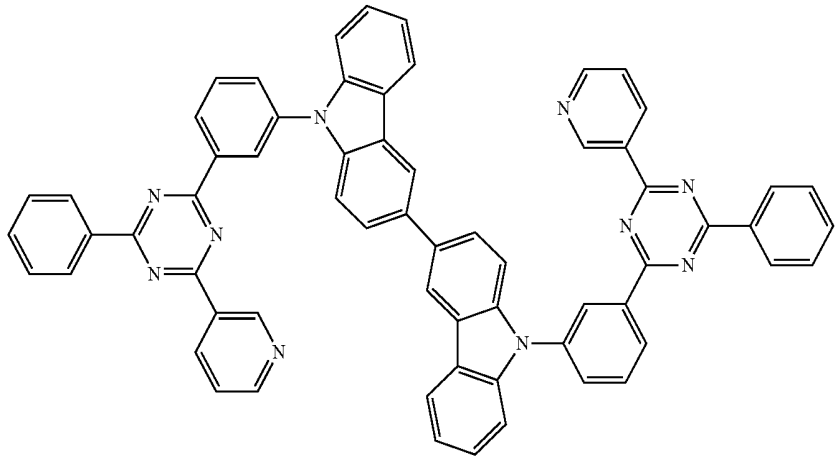

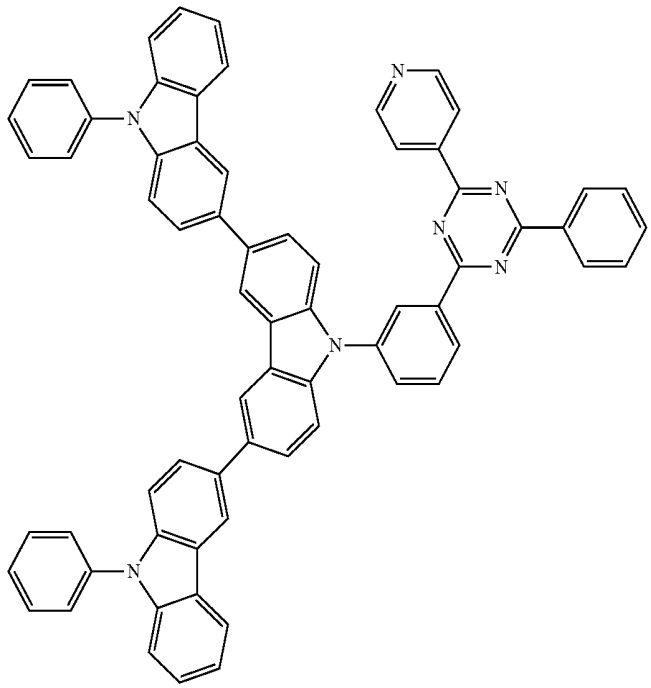

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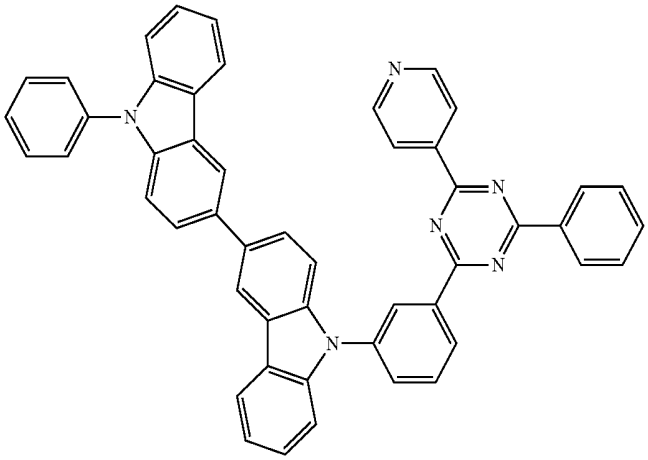

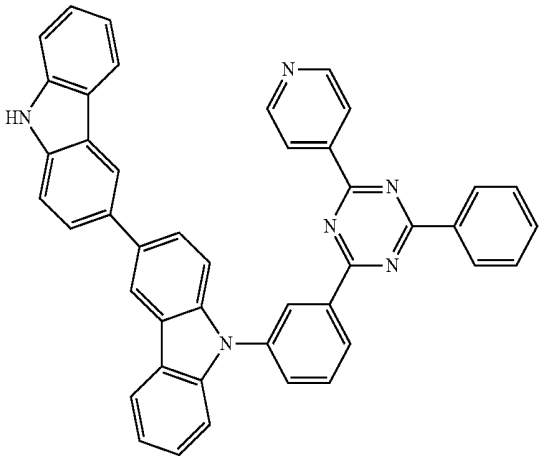

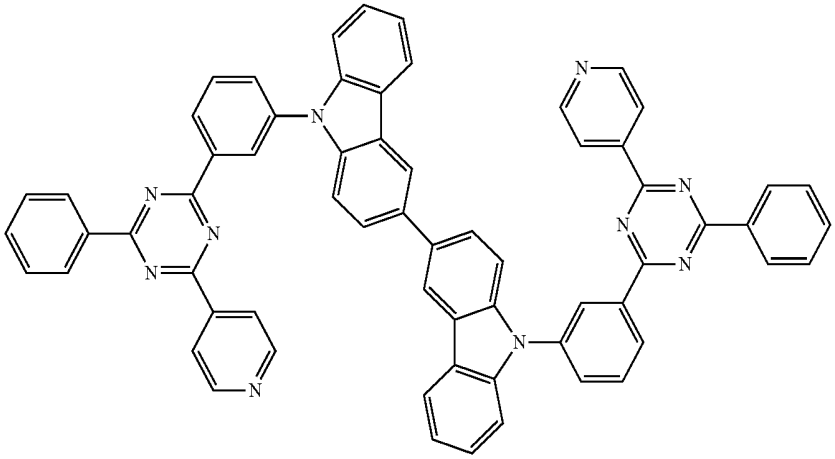

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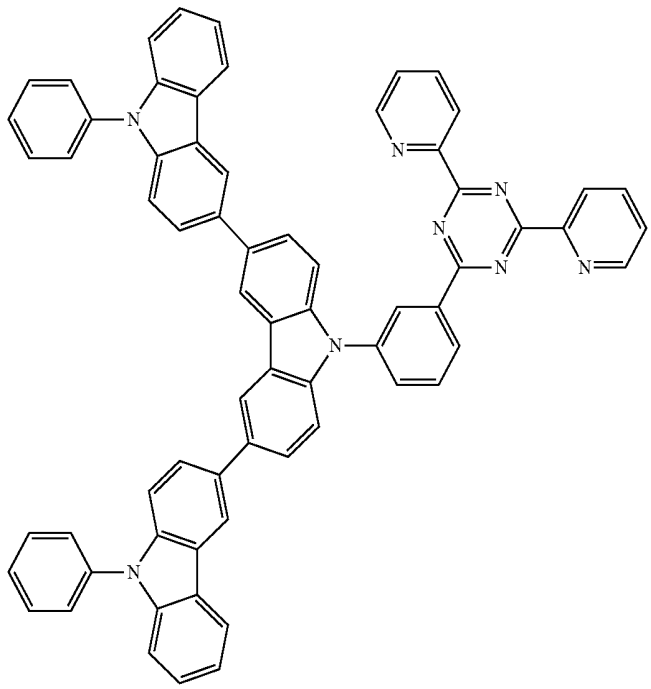

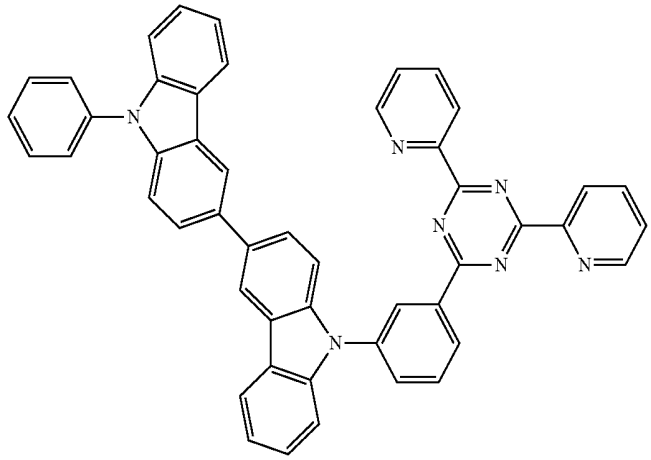

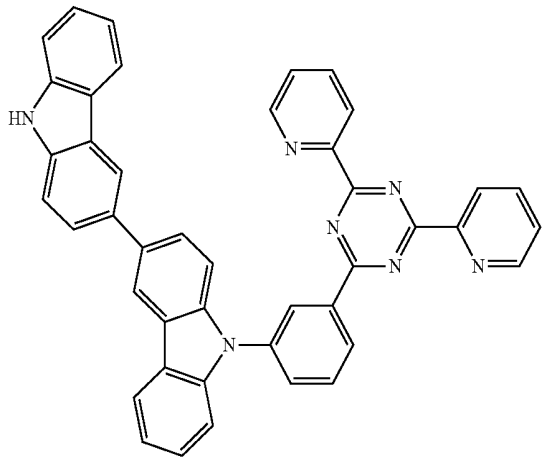

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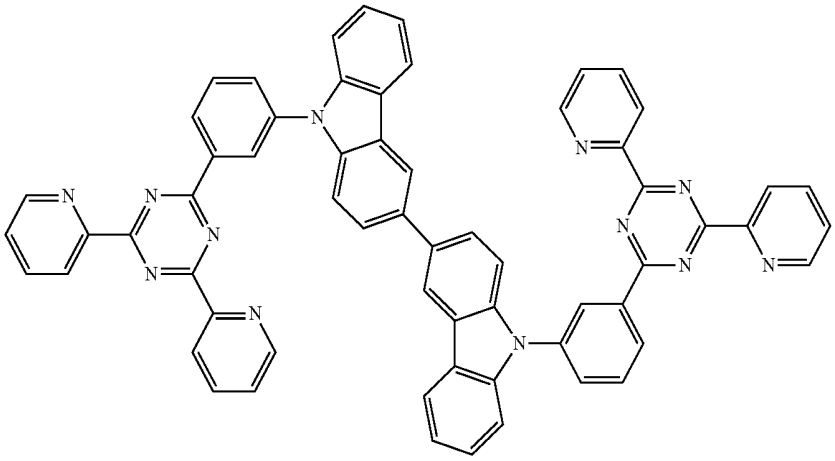

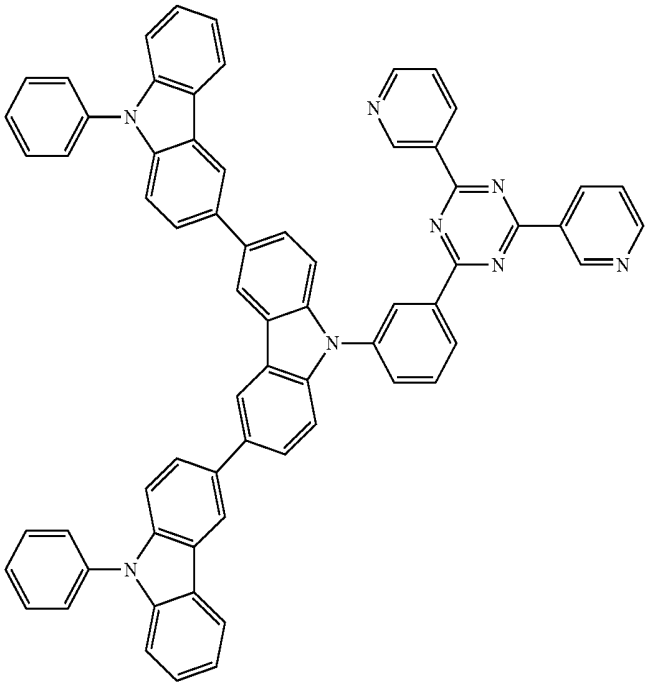

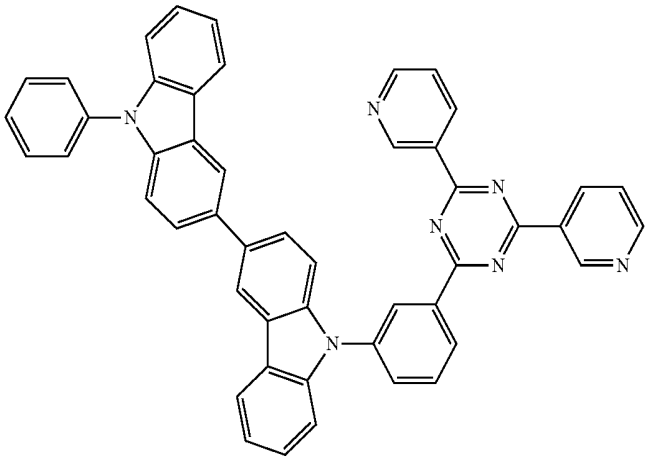

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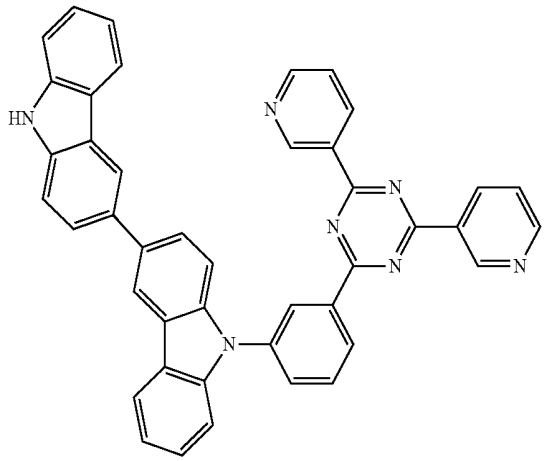

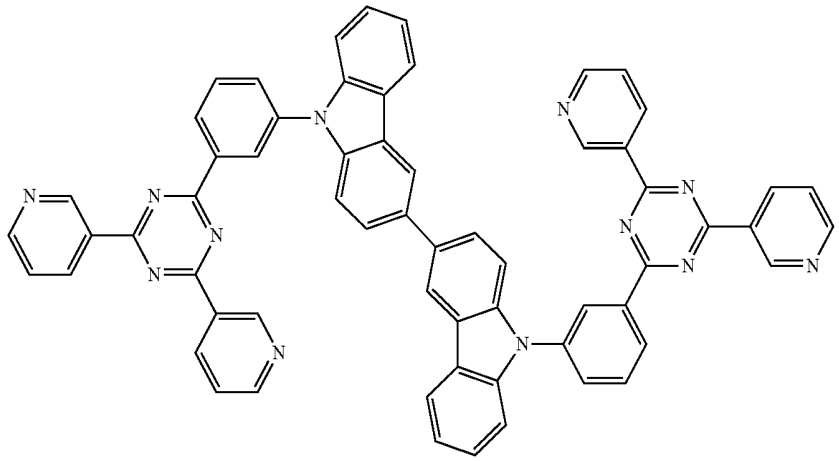

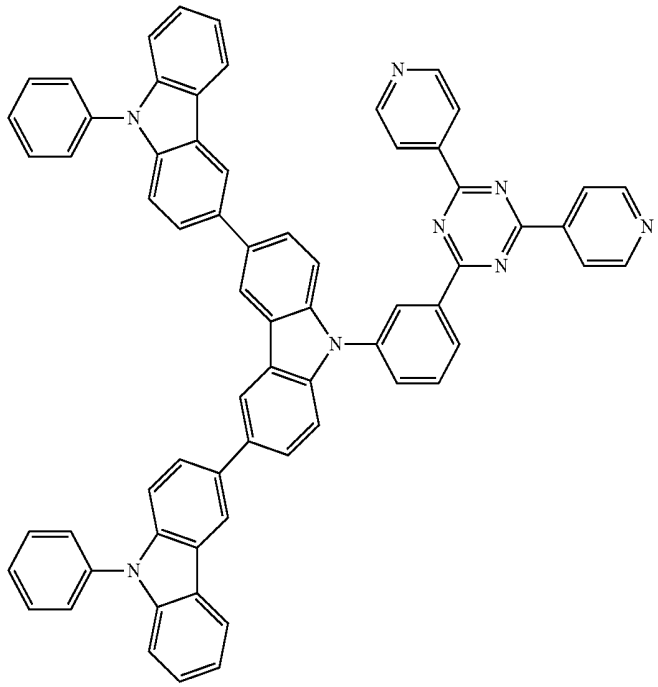

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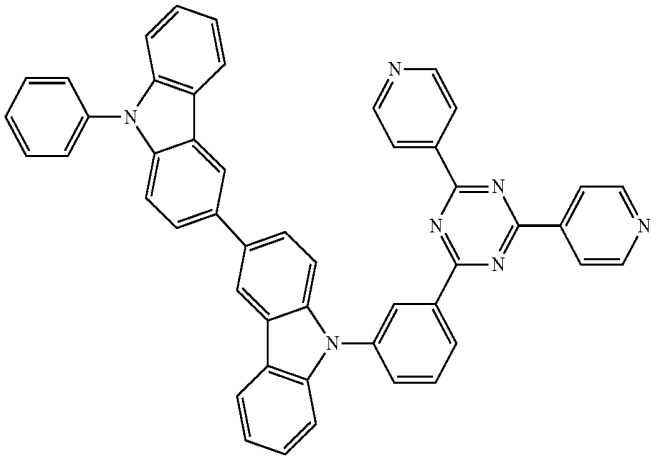
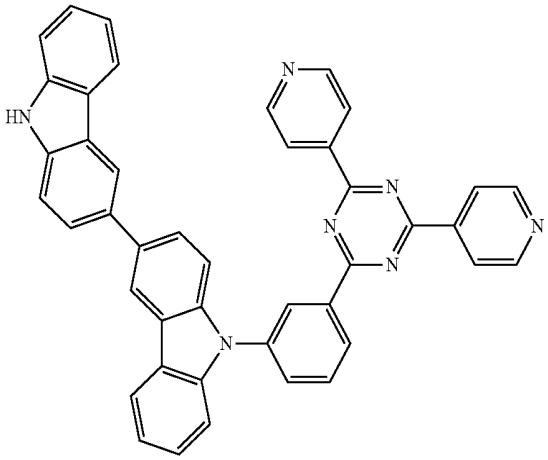
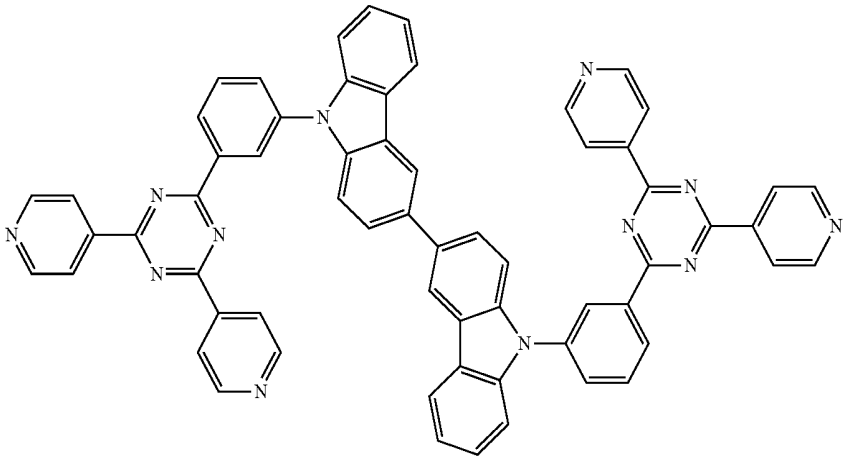
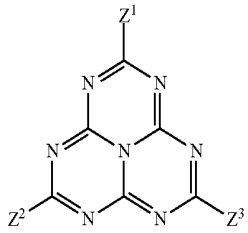






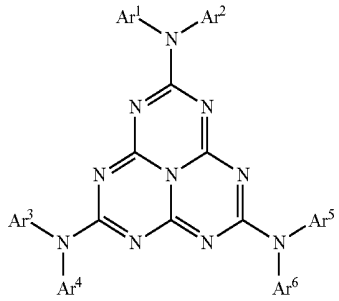
[0143] Examples of the preferred light-emitting material include compounds represented by the following general formulae (211) and (212). The entire description of WO 2013/133359 including the paragraphs 0007 to 0032 and 0079 to 0064 is incorporated herein by reference.

General Formula (211)



wherein in the general formula (231), Z^1, Z^2 and Z^3 each independently represent a substituent.

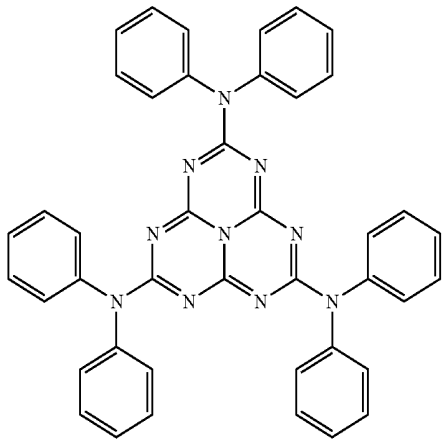
General Formula (212)



wherein in the general formula (212), Ar^1, Ar^2, Ar^3, Ar^4, Ar^5 and Ar^6 each independently represent a substituted or unsubstituted aryl group.

[0144] Specific examples of the compound represented by the general formula (212) include the compound represented by the following structural formula.

Compound 4001



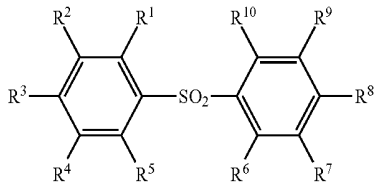
[0145] Specific examples of the compound represented by the general formula (212) include the compounds shown in the following table. In the compounds shown in the table, Ar^1, Ar^2, Ar^3, Ar^4, Ar^5 and Ar^6 are the same as each other, and are expressed by Ar.

TABLE 21

Compound No.	Ar
4002	4-fluorophenyl
4003	3-fluorophenyl
4004	2-fluorophenyl
4005	3,5-difluorophenyl
4006	2,4,6-trifluorophenyl
4007	4-methylphenyl
4008	3-methylphenyl
4009	2-methylphenyl
4010	3,5-dimethylphenyl
4011	2,4,6-trimethylphenyl
4012	4-ethylphenyl
4013	3-ethylphenyl
4014	2-ethylphenyl
4015	3,5-diethylphenyl
4016	4-propylphenyl
4017	3-propylphenyl
4018	3,5-dipropylphenyl
4019	4-tert-butylphenyl
4020	3-tert-butylphenyl
4021	3,5-di-tert-butylphenyl
4022	1-naphthyl
4023	2-naphthyl

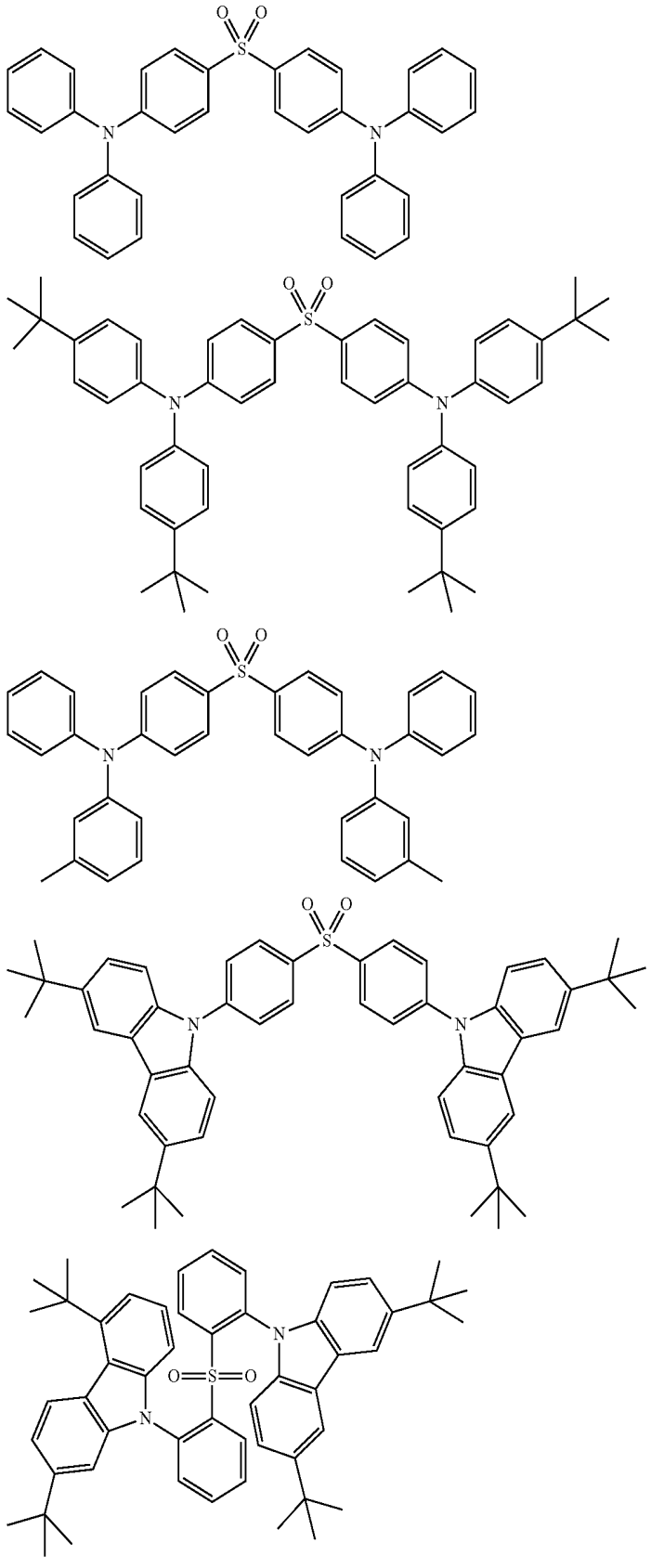
[0146] Examples of the preferred light-emitting material include compounds represented by the following general formula (221). The entire description of WO 2013/161437 including the paragraphs 0008 to 0054 and 0101 to 0121 is incorporated herein by reference.

General Formula (221)



wherein in the general formula (222), R^1 to R^{10} each independently represent a hydrogen atom or a substituent, provided that at least one of R^1 to R^{10} represents a substituted or unsubstituted aryl group, a substituted or unsubstituted diarylamino group or a substituted or unsubstituted 9-carbazolyl group, and R^1 and R^2, R^2 and R^3, R^3 and R^4, R^4 and R^5, R^5 and R^6, R^6 and R^7, R^7 and R^8, R^8 and R^9, and R^9 and R^{10} each may be bonded to each other to form a cyclic structure.

[0147] Specific examples of the compound include the following compounds.



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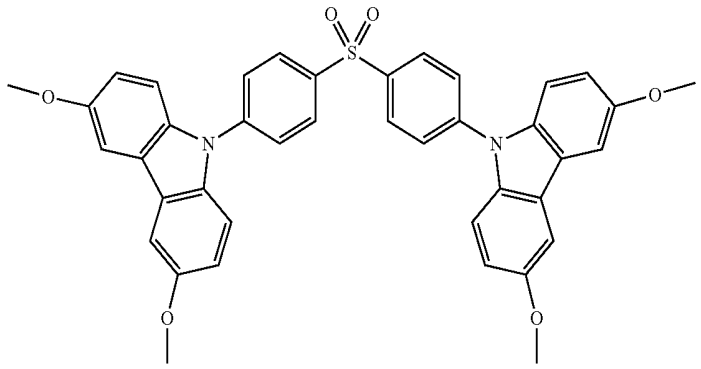

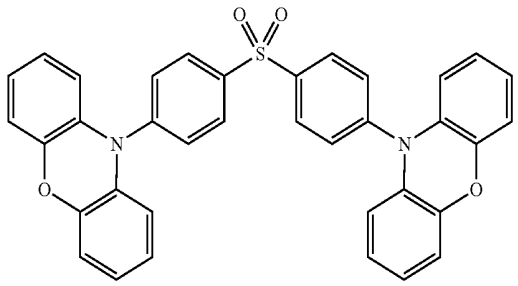

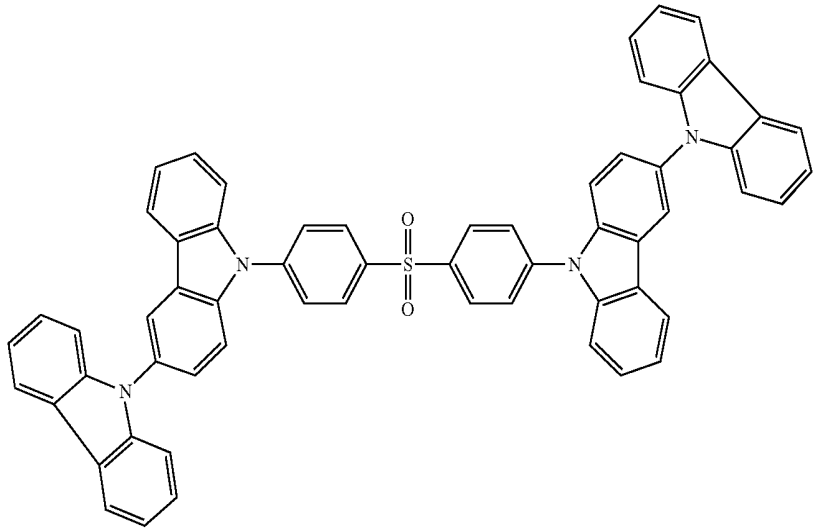

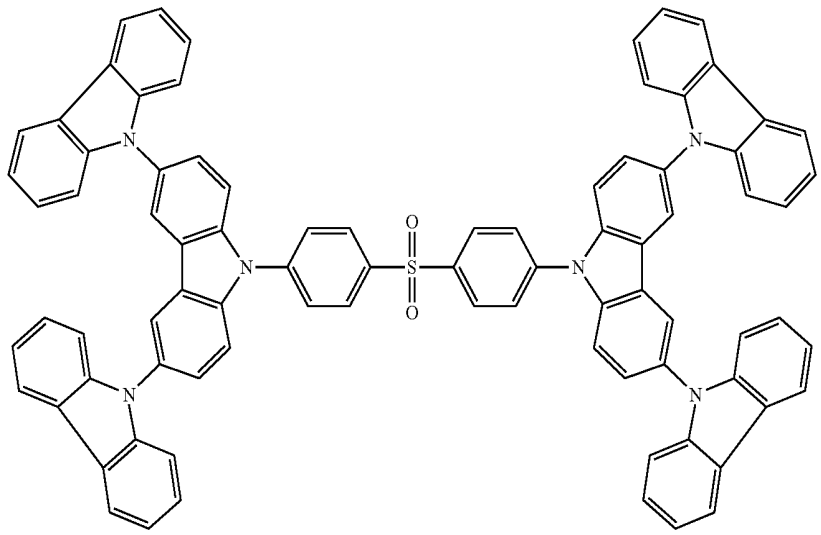

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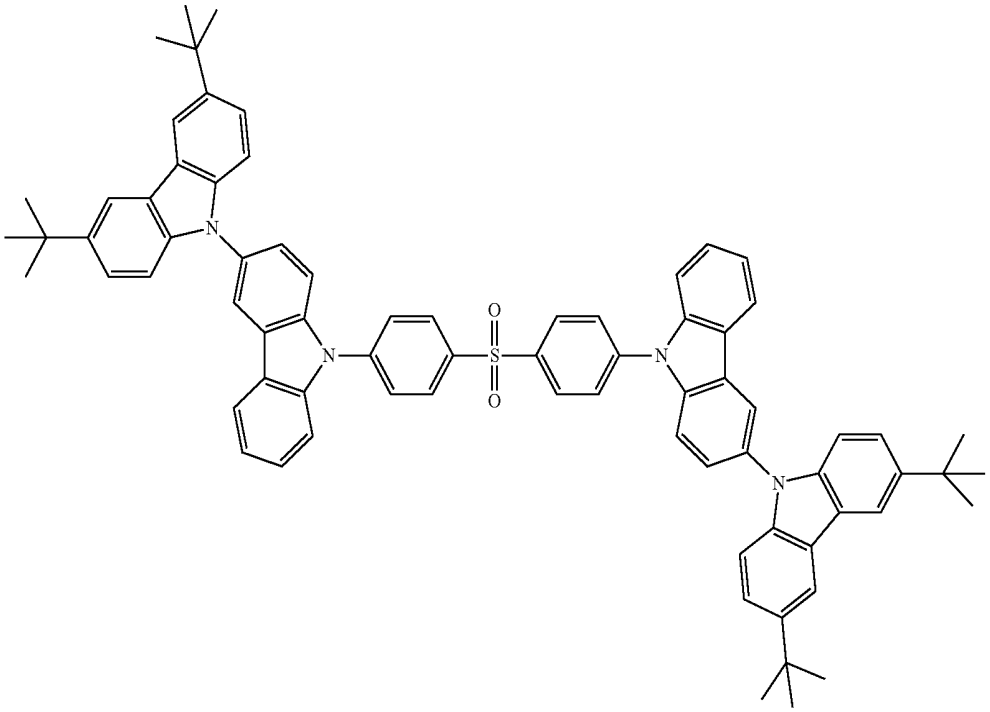

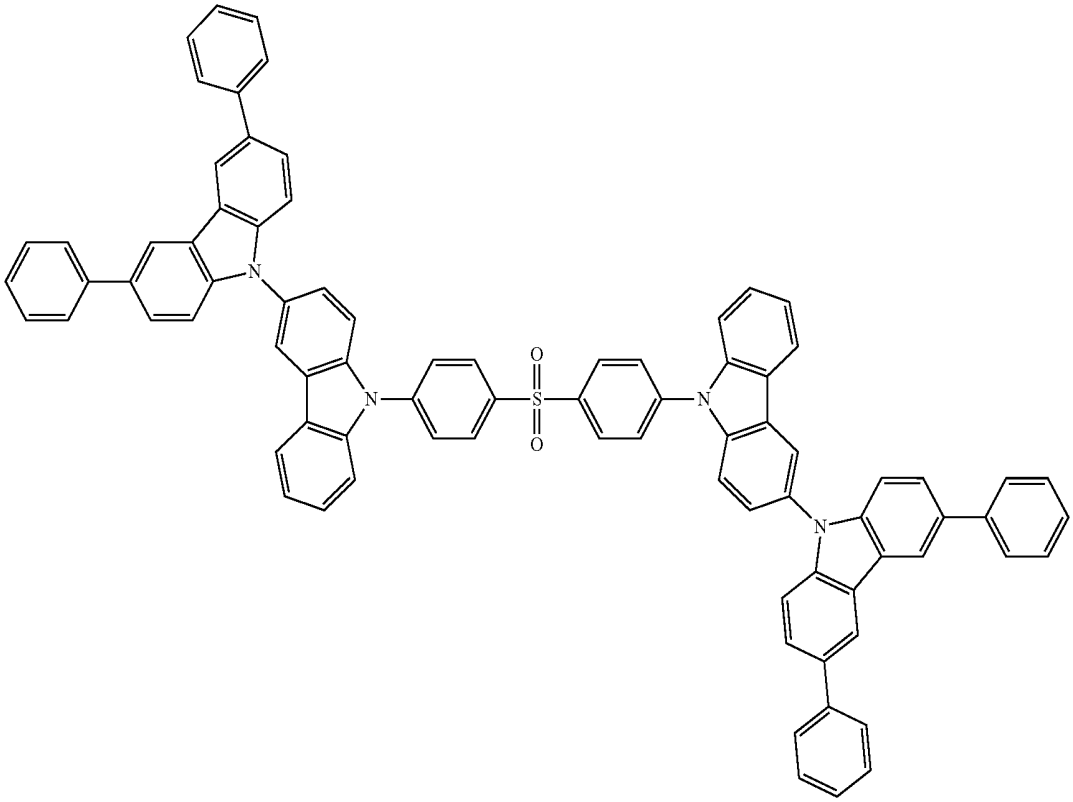

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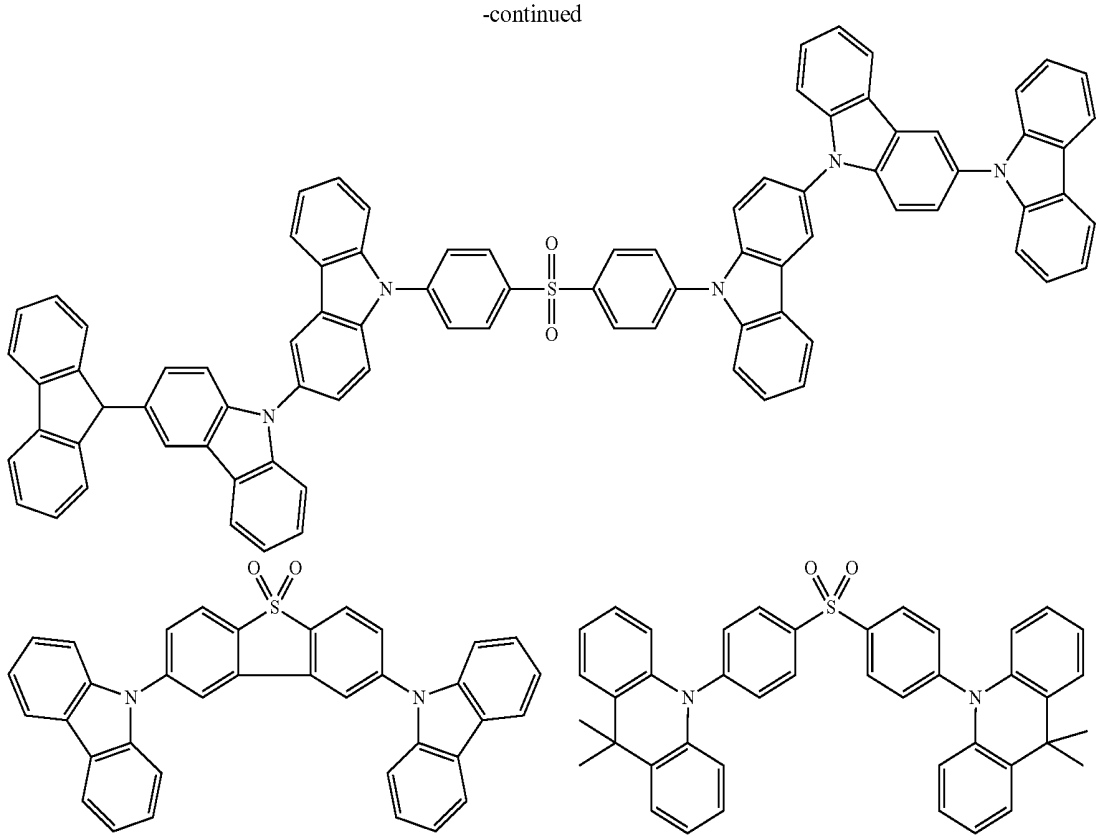
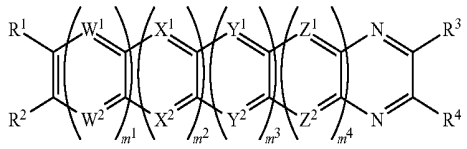


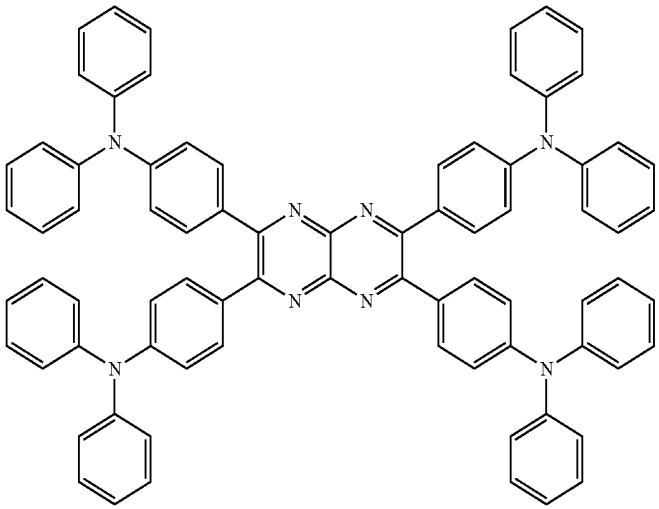
[0148] Examples of the preferred light-emitting material include compounds represented by the following general formula (231). The entire description of JP-A-2014-9352 including the paragraphs 0007 to 0041 and 0060 to 0069 is incorporated herein by reference.

General Formula (231)



wherein in the general formula (231), R^1 to R^4 each independently represent a hydrogen atom or a substituted or unsubstituted (N,N-diarylamino)aryl group, provided that at least one of R^1 to R^4 represents a substituted or unsubstituted (N,N-diarylamino)aryl group, and two aryl groups constituting the diarylamino moiety of the (N,N-diarylamino) aryl group may be bonded to each other; W^1, W^2, X^1, X^2, Y^1, Y^2, Z^1 and Z^2 each independently represent a carbon atom or a nitrogen atom; and m^1 to m^4 each independently represent 0, 1 or 2.

[0149] Specific examples of the compound include the following compounds,



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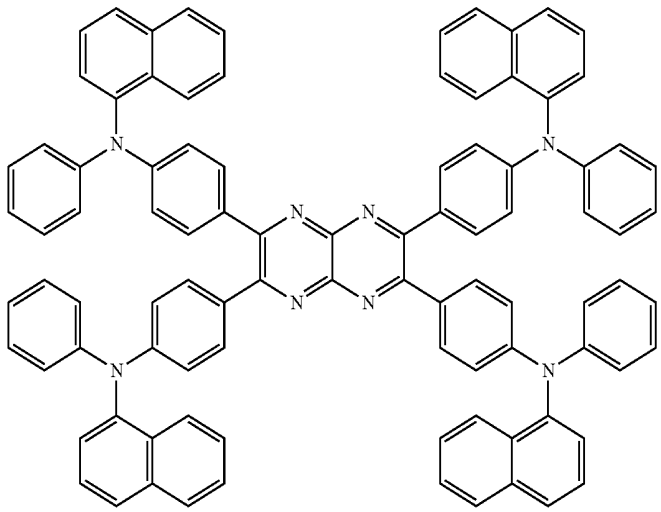

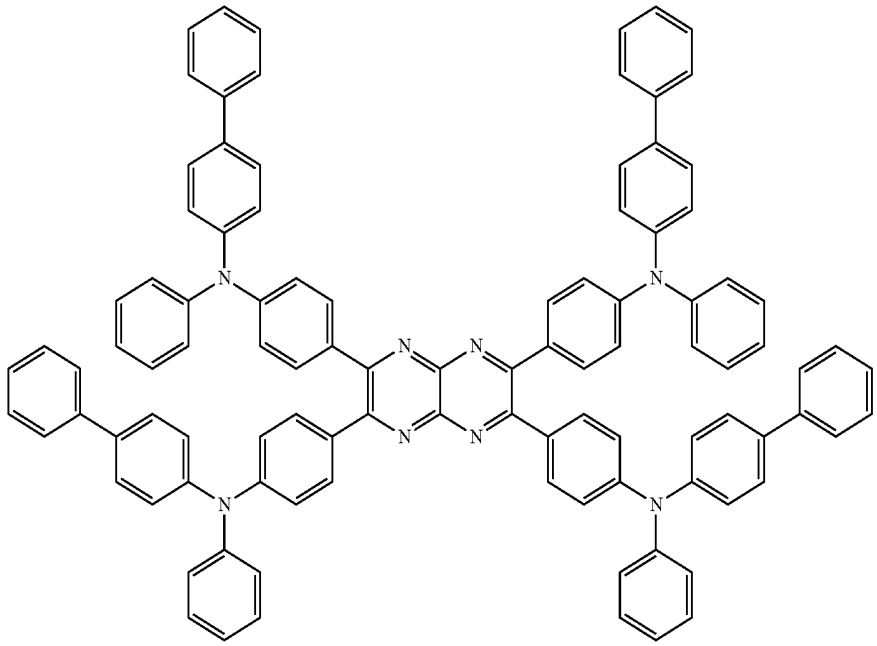

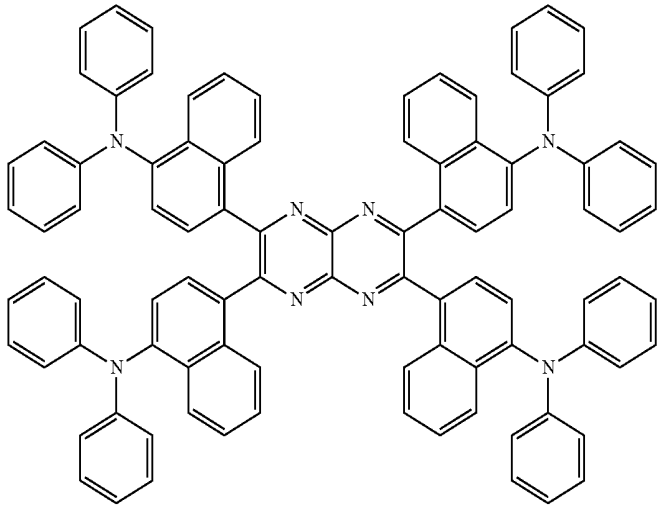

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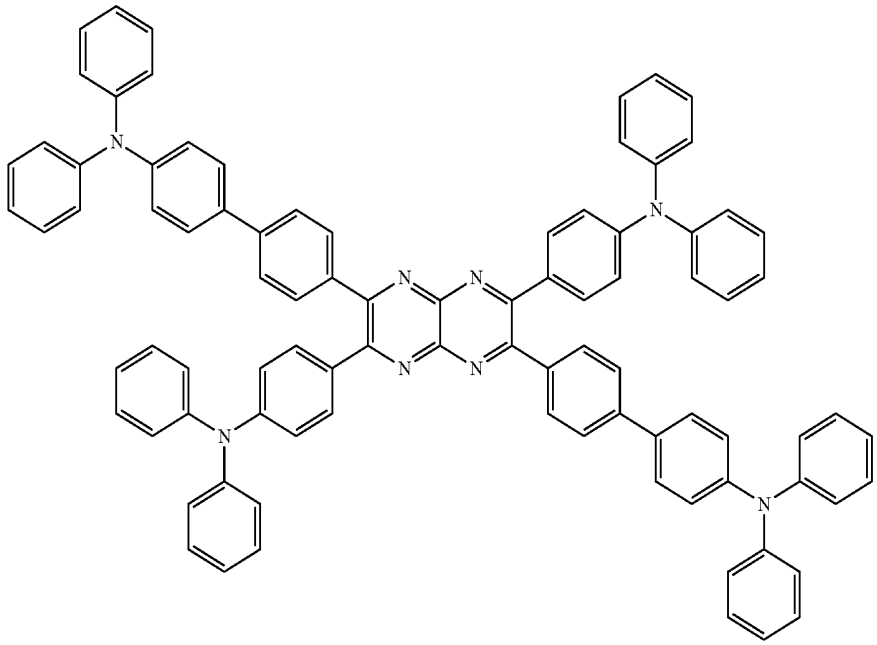

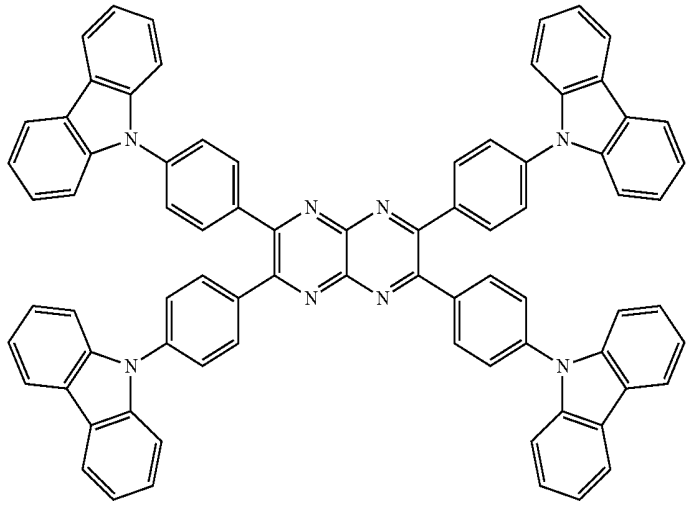

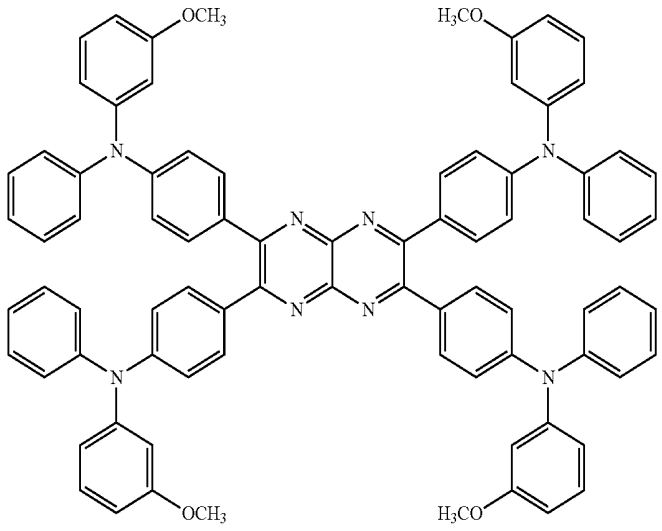

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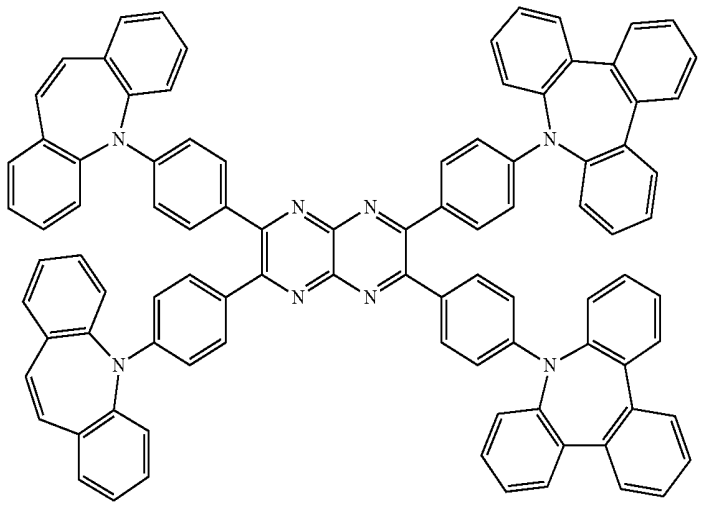

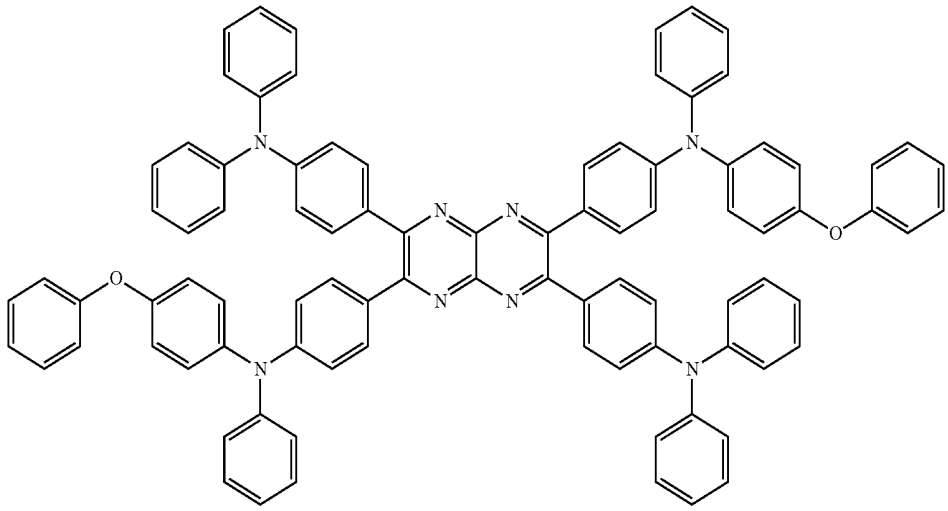

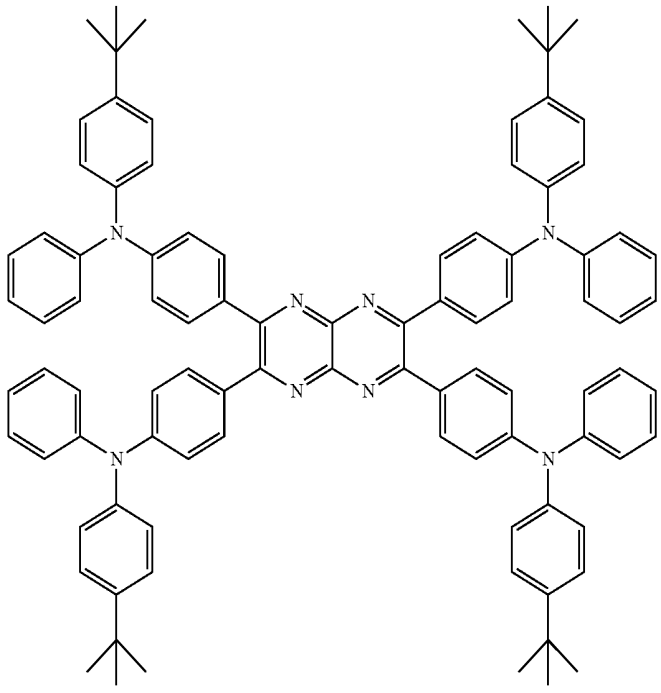

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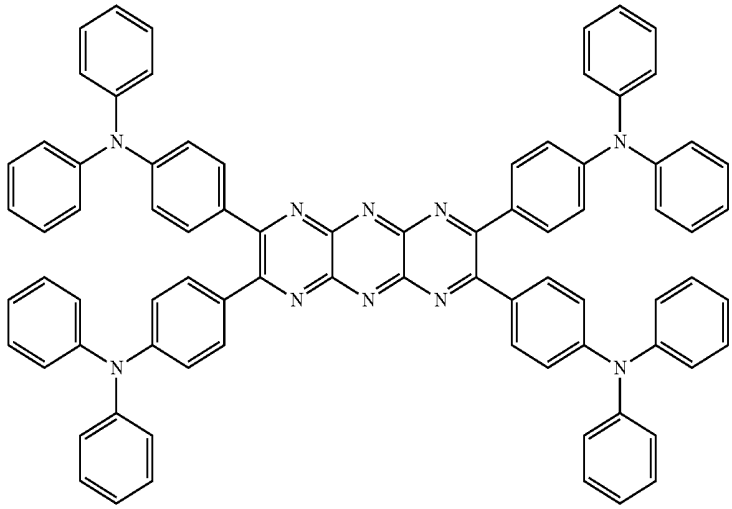

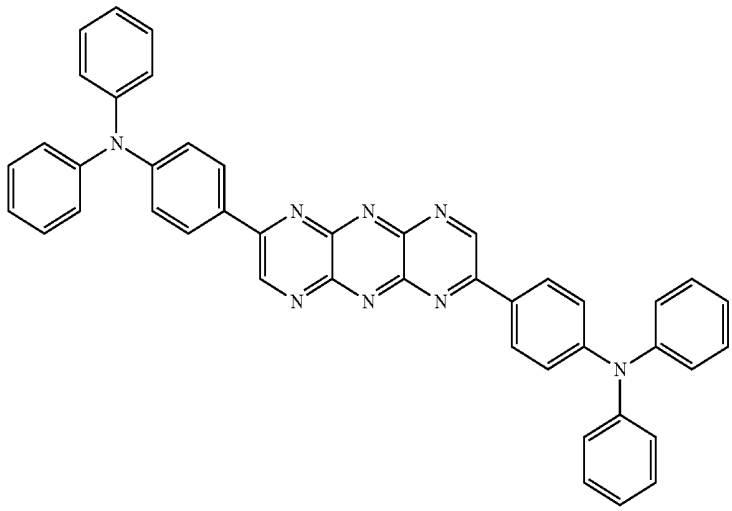

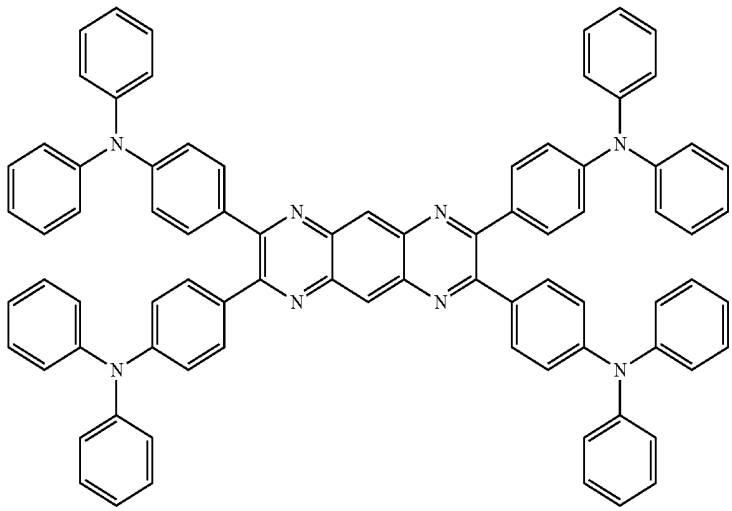

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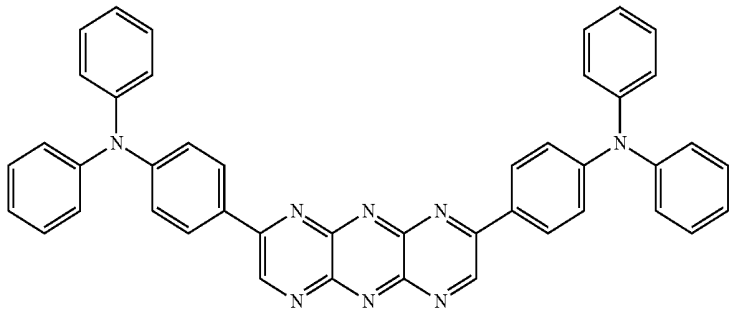

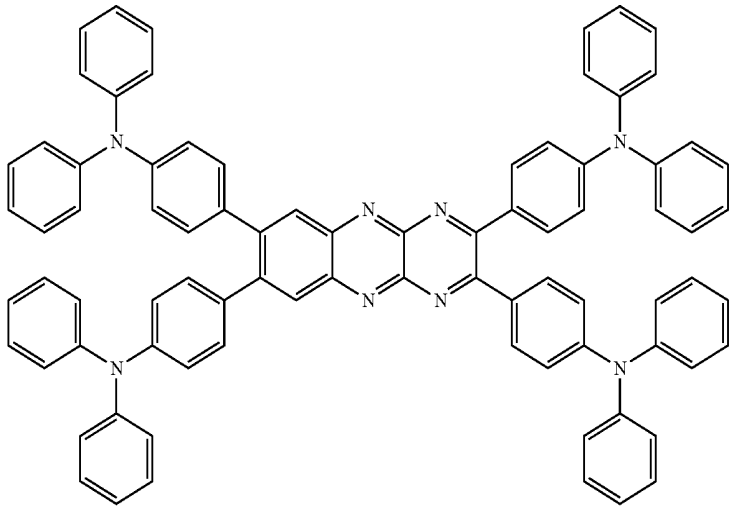

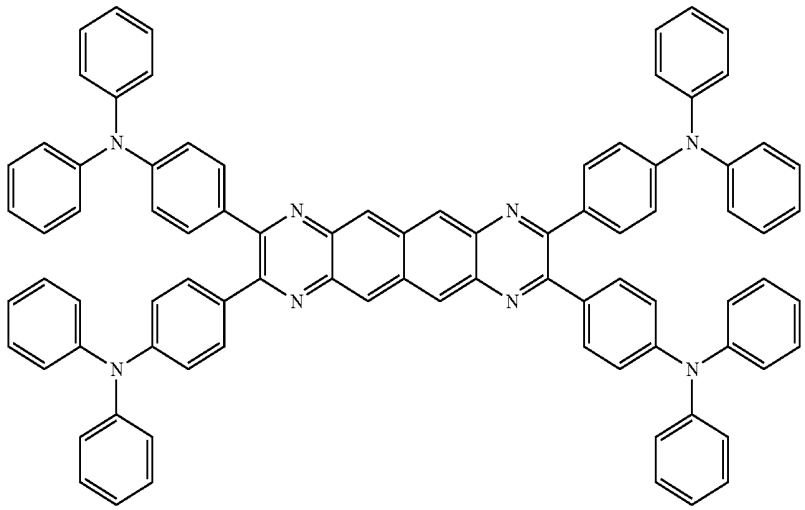

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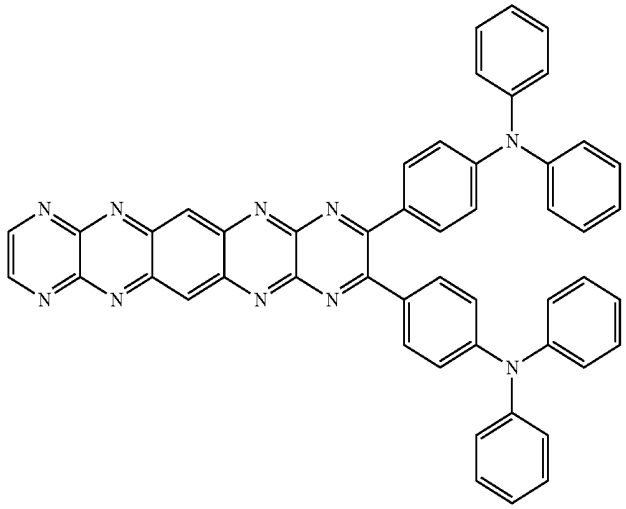

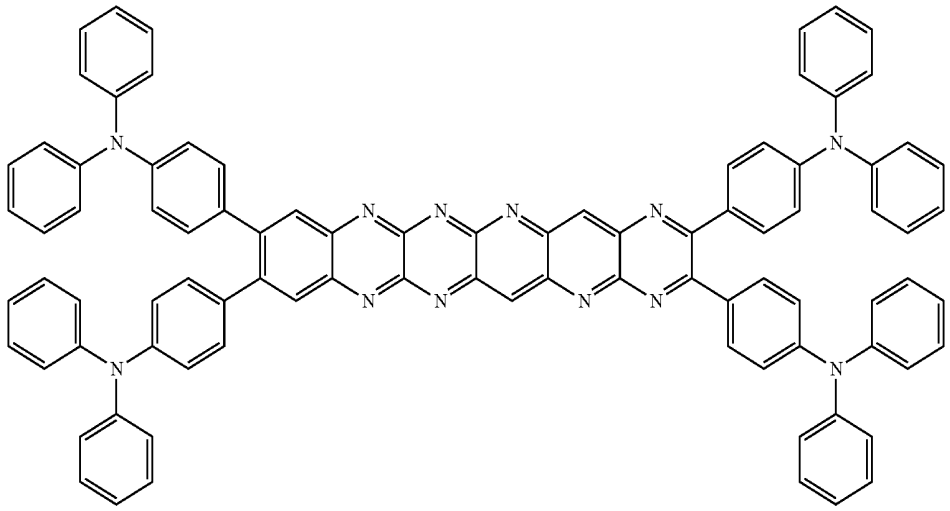

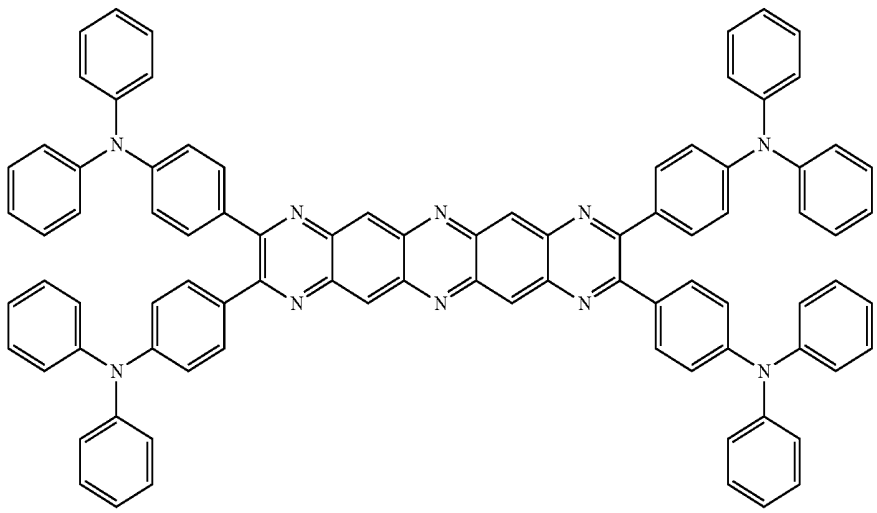

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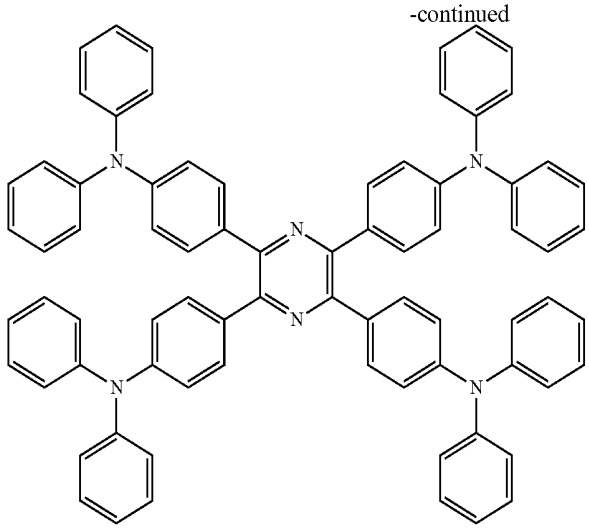
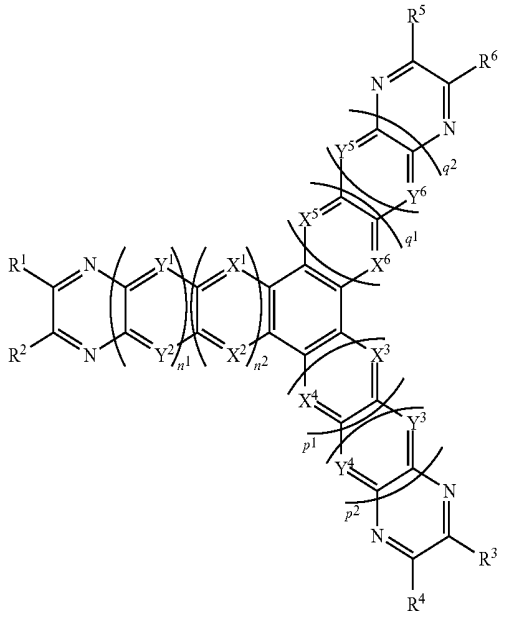


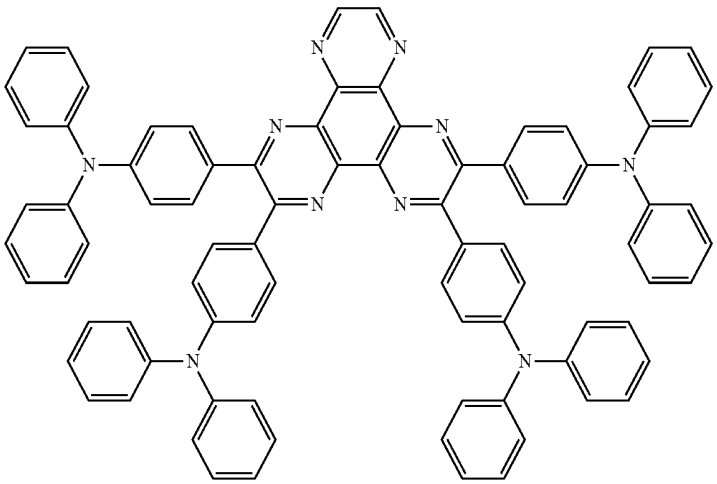
[0150] Examples of the preferred light-emitting material include compounds represented by the following general formula (241). The entire description of JP-A-2014-9224 including the paragraphs 0008 to 0048 and 0067 to 0076 is Incorporated herein by reference.

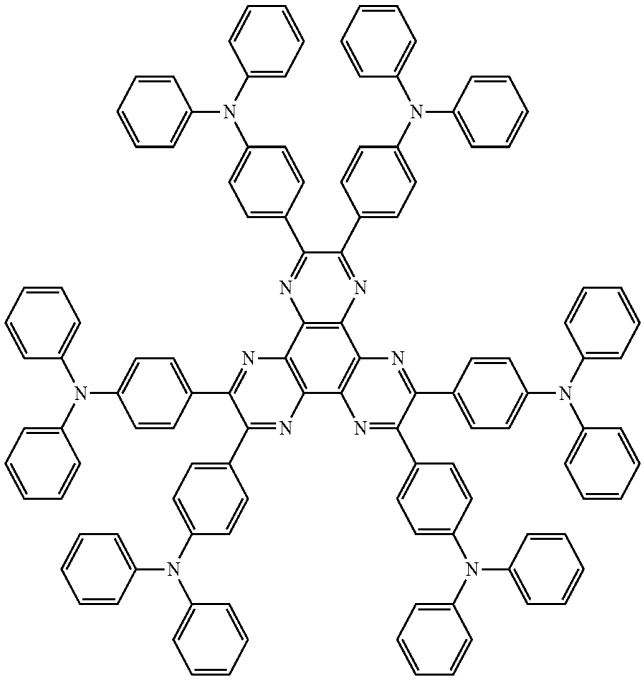
General Formula (241)



wherein in the general formula (241), R^1 to R^6 each independently represent a hydrogen atom or a substituent, provided that at least one of R^1 to R^6 represents a substituted or unsubstituted (N,N-diarylamino)aryl group, and two aryl groups constituting the diarylamino moiety of the (N,N-diarylamino)aryl group nay be bonded to each other; X^1 to X^6 and Y^1 to Y^6 each independently represent a carbon atom or a nitrogen atom; and n^1, n^2, p^1, p^2, q^1 and q^2 each independently represent 0, 1 or 2.

[0151] Specific examples of the compound include the following compounds.





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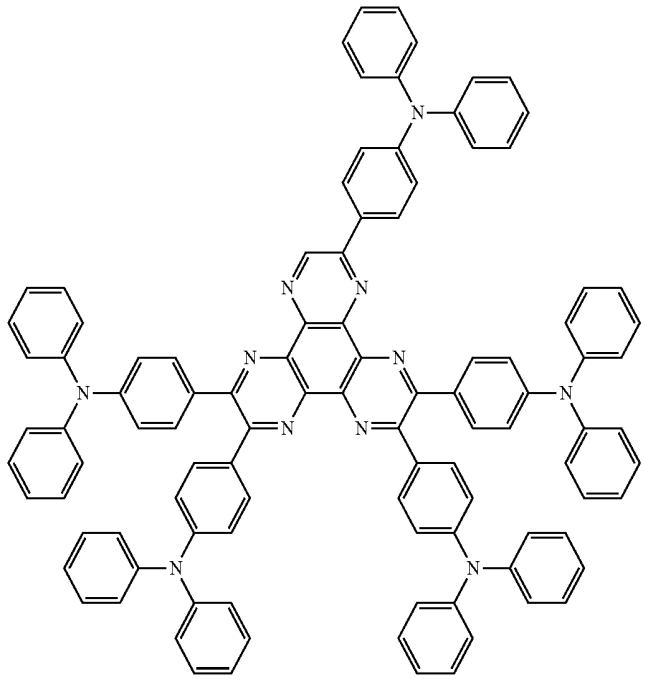

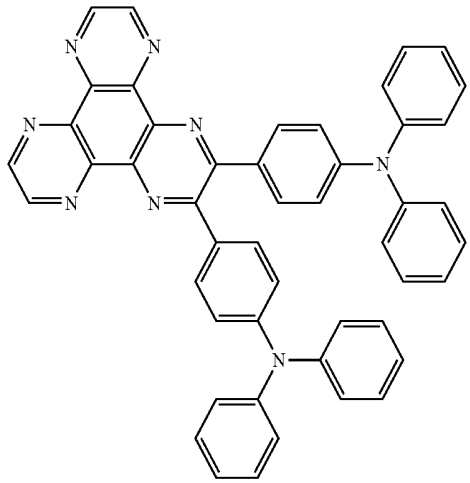

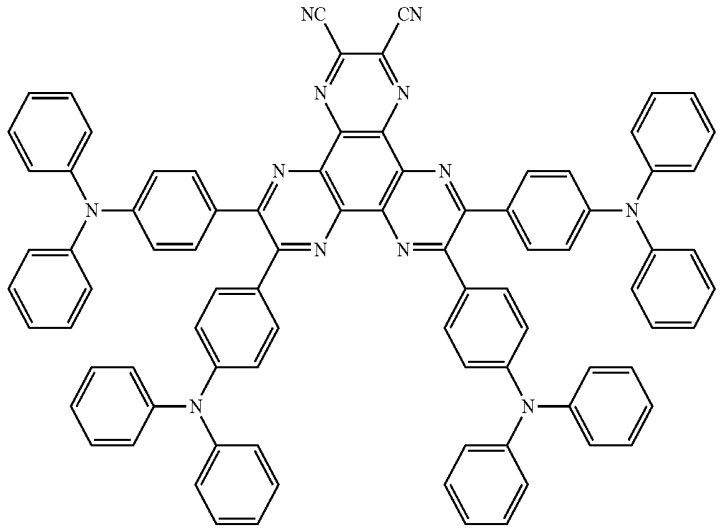

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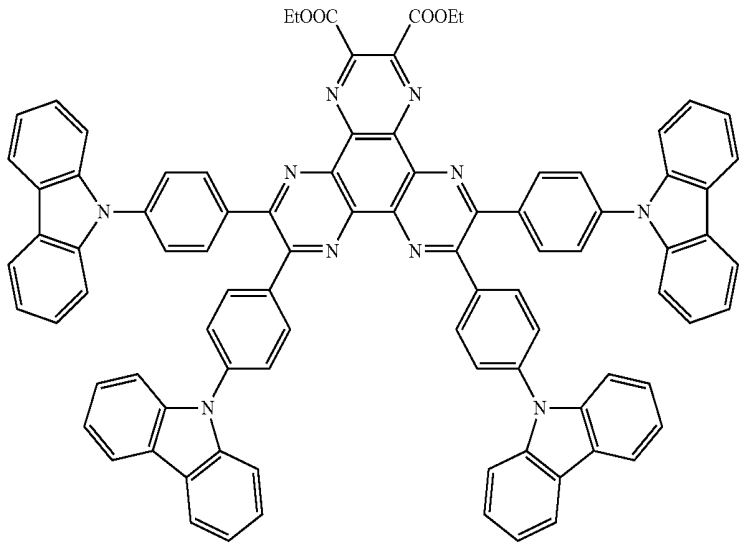
EtOOC
COOEt
N
N
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N
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N
N
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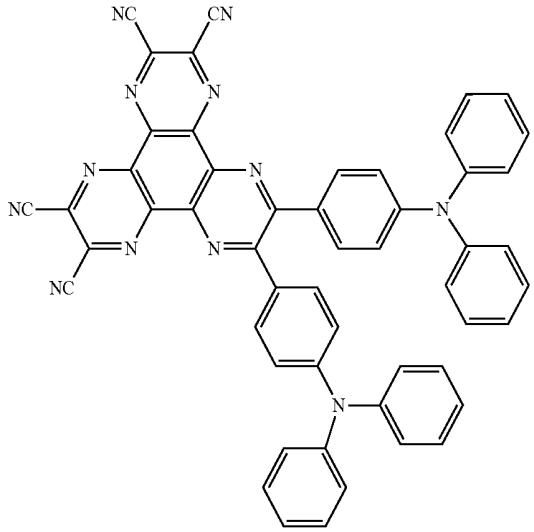
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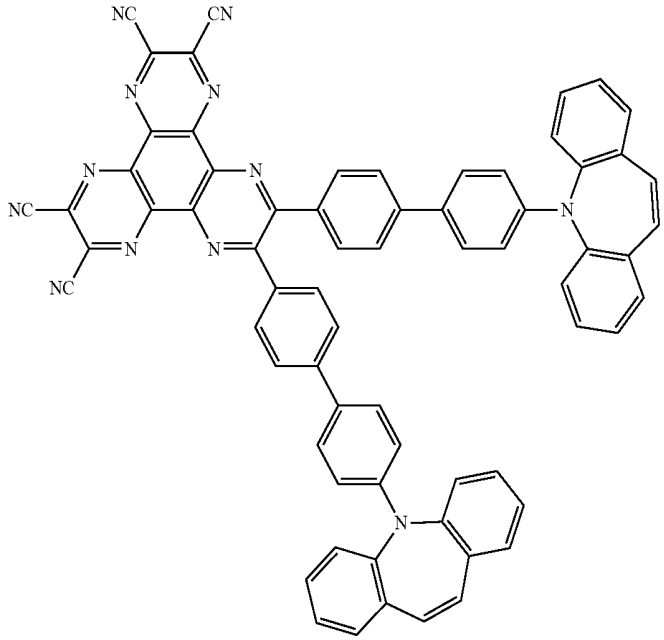
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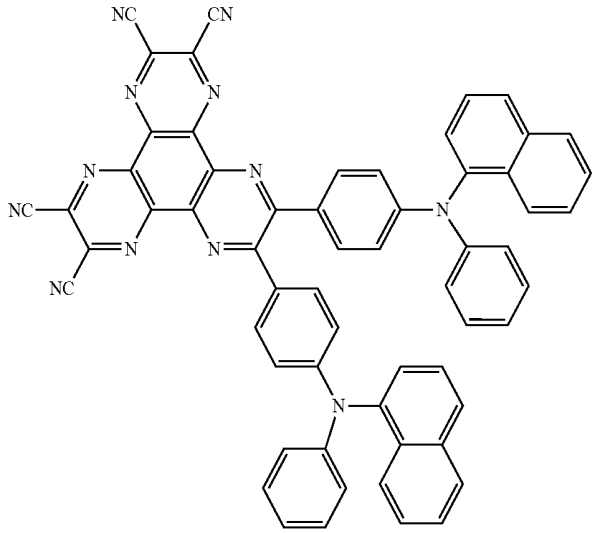

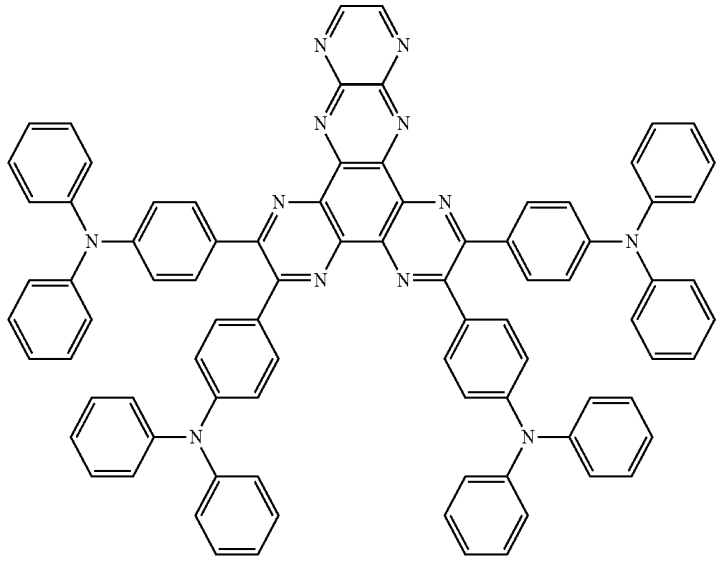

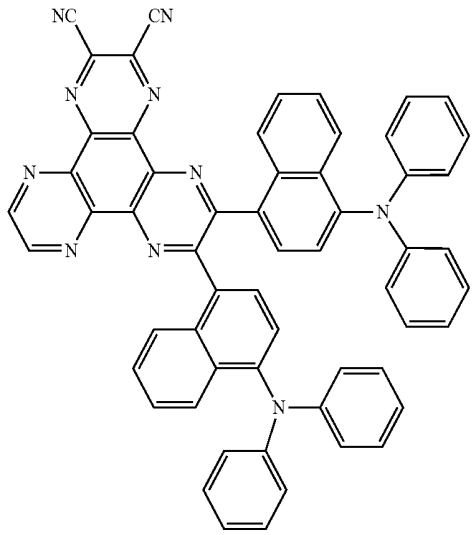

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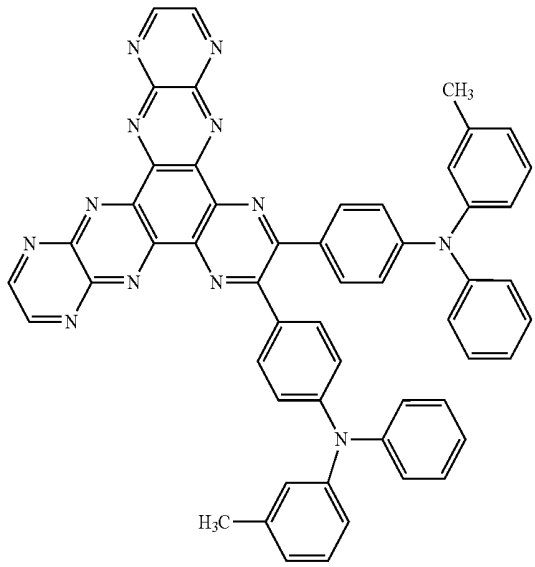

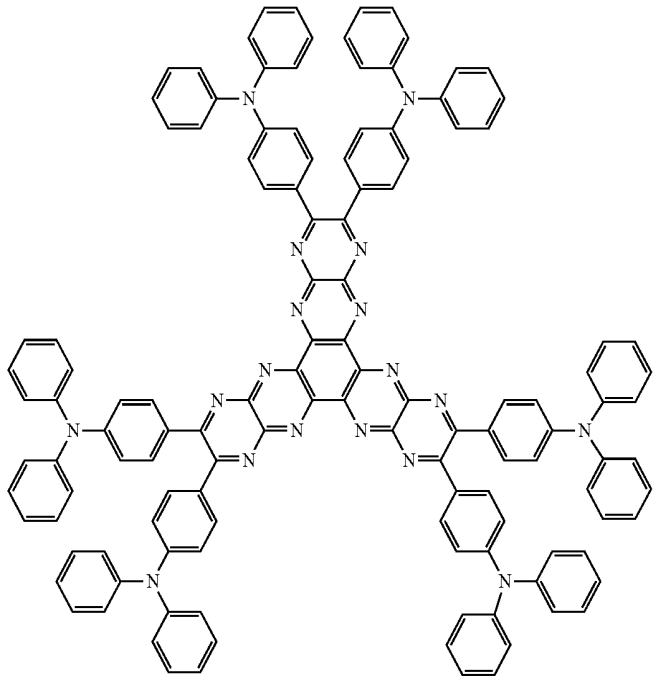

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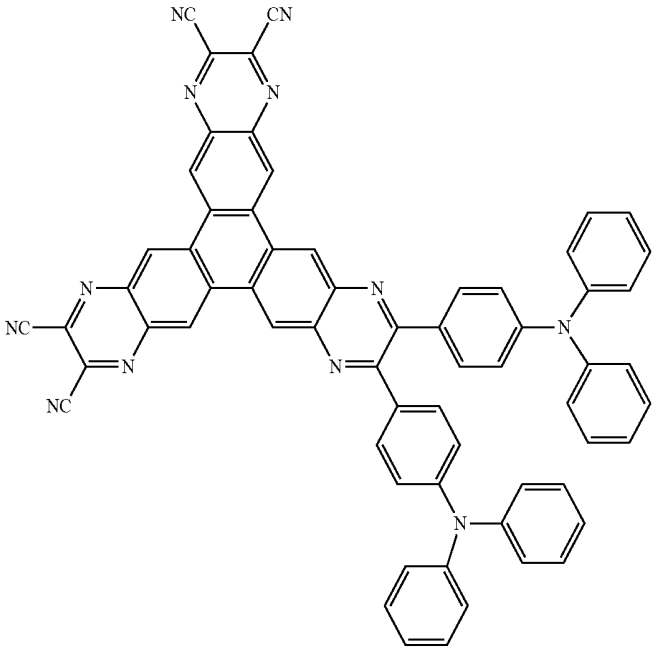

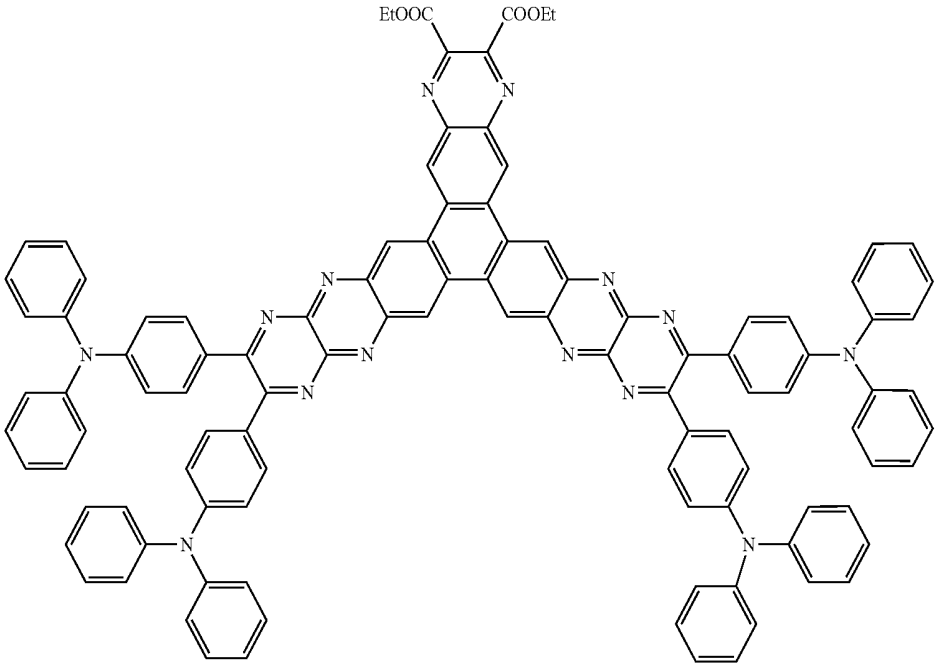

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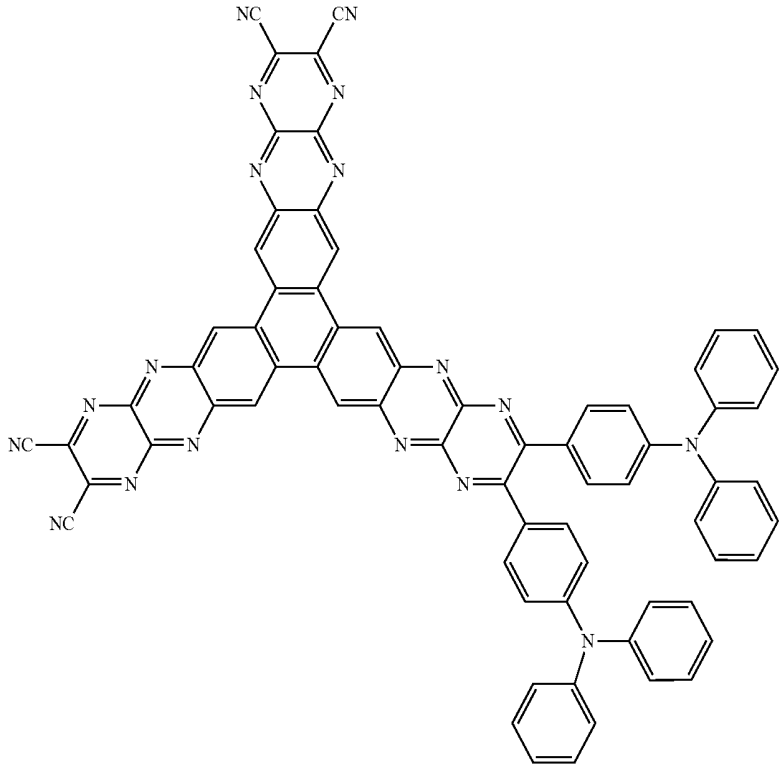
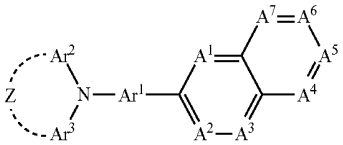


[0152] Examples of the preferred light-emitting material include the following compounds.

[0153] (1) A compound represented by the following general formula (251):

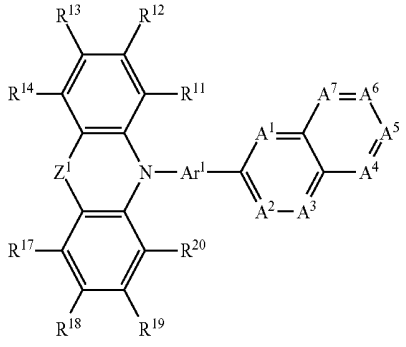
General Formula (251)



wherein in the general formula (251), one of A^1 to A^7 represents N, and the balance each independently represent. C—R; R represents a non-aromatic group; Ar^1 to Ar^3 each independently represent a substituted or unsubstituted arylene group; and Z represents a single bond or a linking group.

[0154] (2) The compound according to the item (1), wherein the compound represented by the general formula (251) has a structure represented by the following general formula (252):

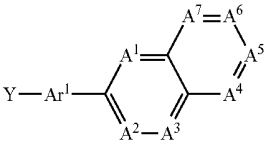
General Formula (252)



wherein in the general formula (252), one of A^1 to A^7 represents N, and the balance each independently represent C—R; R represents a non-aromatic group; Ar^1 represents a substituted or unsubstituted arylene group; R^{11} to R^{14} and R^{17} to R^{20} each independently represent a hydrogen atom or a substituent, in which R^{11} and R^{12}, R^{12} and R^{13}, R^{13} and R^{14}, R^{17} and R^{18}, R^{18} and R^{19}, and R^{19} and R^{20} each may be bonded to each other to form a cyclic structure; and Z^1 represents a single bond or a linking group having 1 or 2 linking chain atoms.

[0155] (3) The compound according to the item (1), wherein the compound represented by the general formula (251) has structure represented by the following general formula (253):

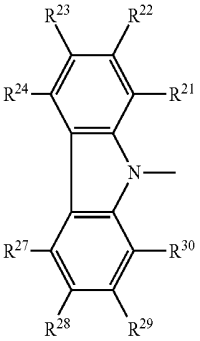
General Formula (253)



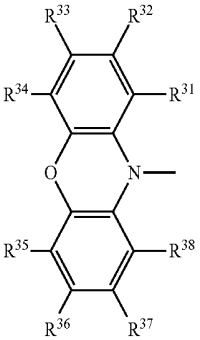
wherein in the general formula (253), from 2 to 4 of A^1 to A^7 represent H, and the balance represent C—R; R represents a non-aromatic group; Ar^1 represents a substituted or unsubstituted arylene group; and Y represents a substituted or unsubstituted carbazol-9-yl group, a substituted or unsubstituted 10H-phenoxazin-10-yl group, a substituted or unsubstituted 10H-phenothiazin-10-yl group, or a substituted or unsubstituted 10H-phenazin-5-yl group.

[0156] (4) The compound according to the item (3), wherein in the general, formula (253), Y represents a group represented by any one of the following general formulae (254) to (257):

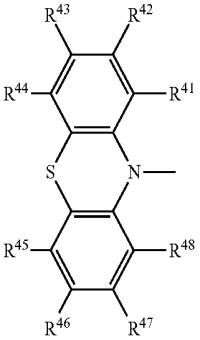
General Formula (254)



General Formula (255)



General Formula (256)



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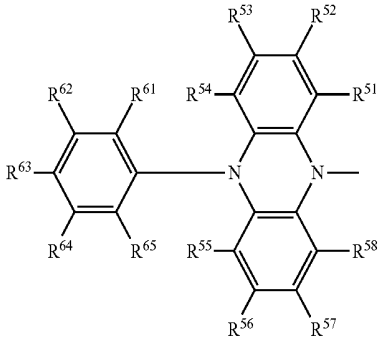
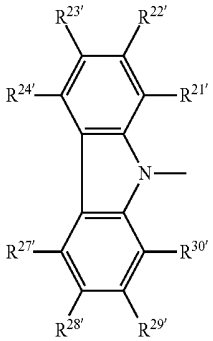
General Formula (257)



wherein in the general formulae (254) to (257), R^{21} to R^{24}, R^{27} to R^{28}, R^{41} to R^{48}, R^{51} to R^{54}, and R^{61} to R^{65} each independently represent a hydrogen atom or a substituent in which R^{21} and R^{22}, R^{22} and R^{23}, R^{23} and R^{24}, R^{27} and R^{28}, R^{28} and R^{29}, R^{29} and R^{30}, R^{31} and R^{32}, R^{32} and R^{33}, R^{33} and R^{34}, R^{35} and R^{36}, R^{36} and R^{37}, R^{37} and R^{38}, R^{41} and R^{43}, R^{42} and R^{43}, R^{43} and R^{44}, R^{45} and R^{46}, R^{46} and R^{47}, R^{47} and R^{48}, R^{51} and R^{52}, R^{52} and R^{53}, R^{53} and R^{54}, R^{55} and R^{56}, R^{56} and R^{57}, R^{57} and R^{58}, R^{61} and R^{62}, R^{62} and R^{63}, R^{63} and R^{64}, R^{64} and R^{65}, R^{54} and R^{61}, R^{55} and R^{65}, each may be bonded to each other to form a cyclic structure.

[0157] (5) The compound according to the item (3), wherein in the general formula (253), Y represents a group represented by the following general formula (258):

General Formula (258)



wherein in the general formula (258), $R^{21'}$ to $R^{24'}$ and $R^{27'}$ to $R^{30'}$ each independently represent a hydrogen atom or a substituent, provided that at least one of $R^{23'}$ and $R^{28'}$ represents a substituent, and $R^{21'}$ and $R^{22'}$, $R^{22'}$ and $R^{23'}$, $R^{23'}$ and $R^{24'}$, $R^{27'}$ and $R^{28'}$, $R^{28'}$ and $R^{29'}$, and $R^{29'}$ and $R^{30'}$ each may be bonded to each other to form a cyclic structure.

[0158] (6) The compound according no the item (5), wherein in the general formula (258), at least one of $R^{23'}$ and $R^{28'}$ represents a substituted or unsubstituted diarylamino group or a substituted or unsubstituted carbazol-9-yl group.

[0159] (7) The compound according to the item (4), wherein In the general formula (253), Y represents a group represented by the general formula (255).

[0160] Examples of the compound include the following compounds.

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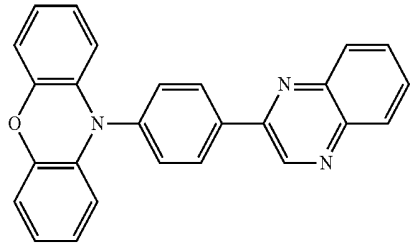

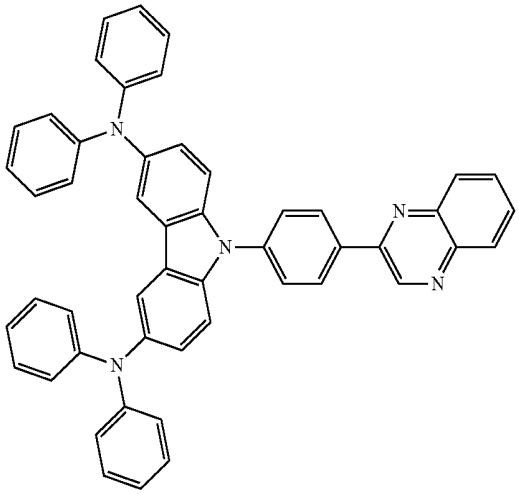

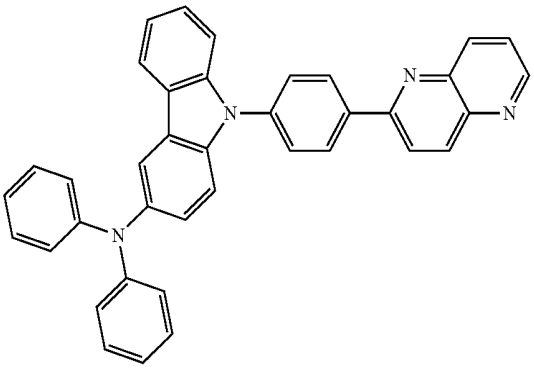

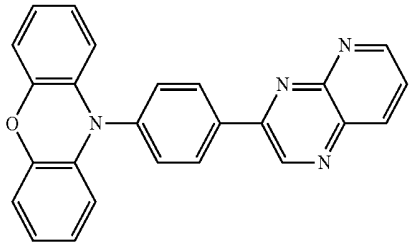

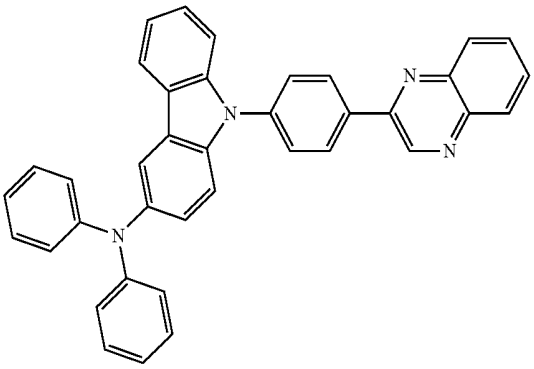

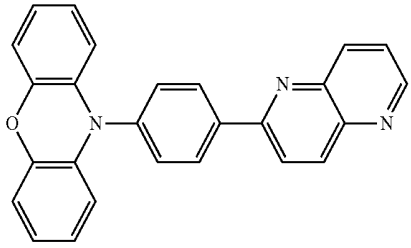

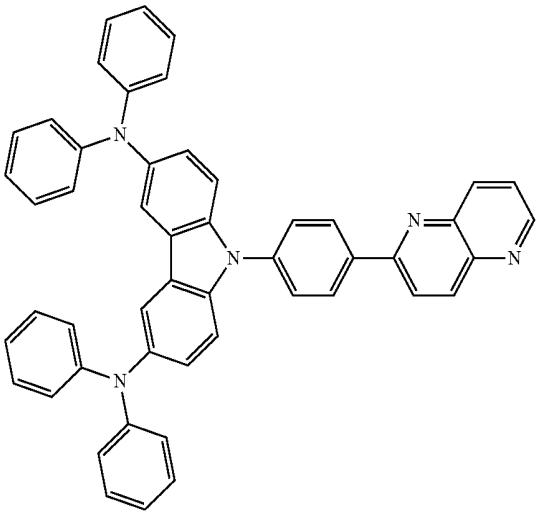

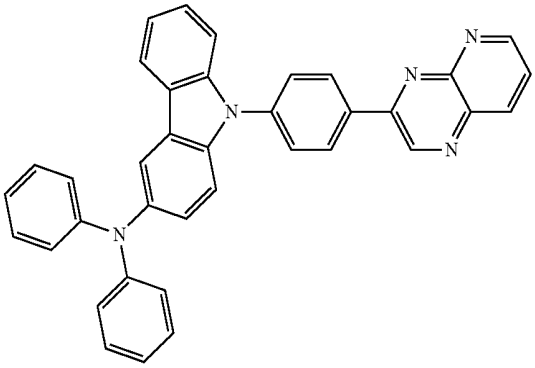

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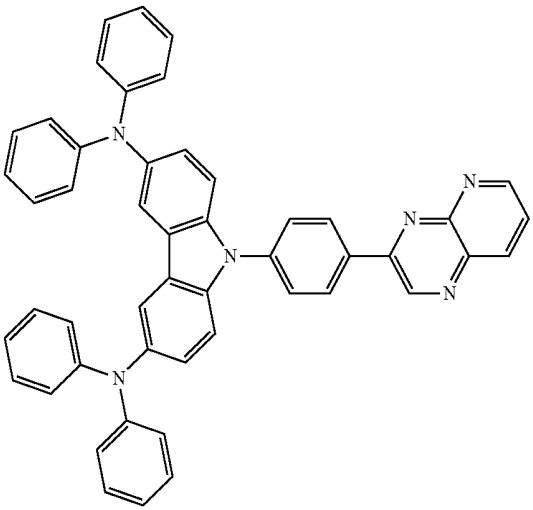

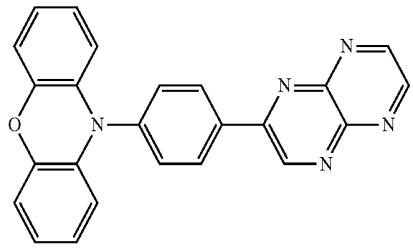

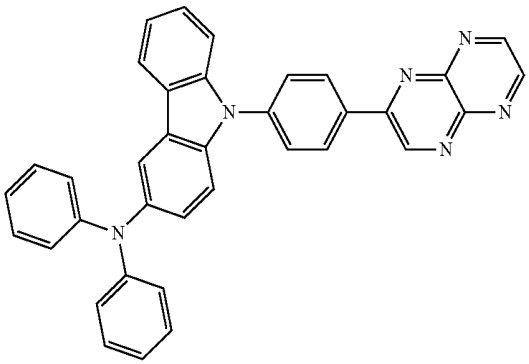

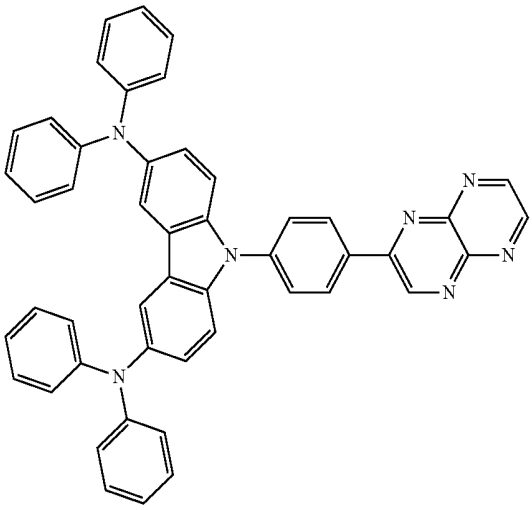

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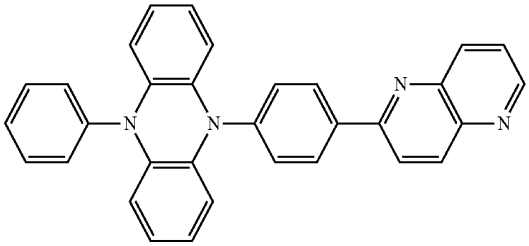

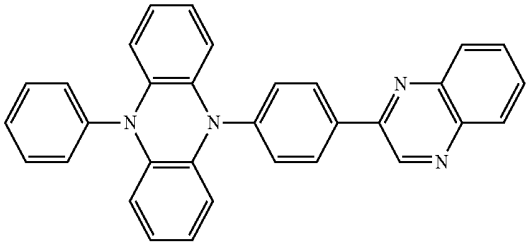

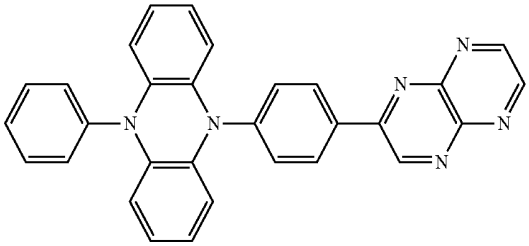

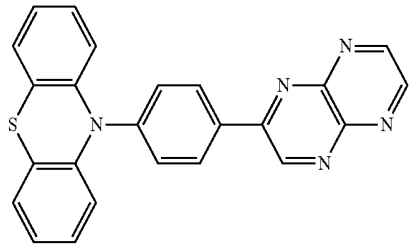

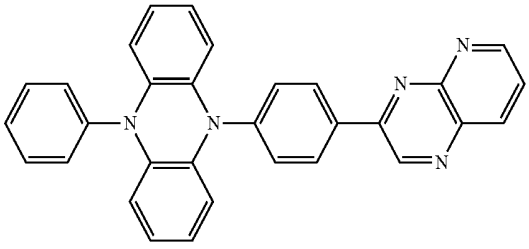

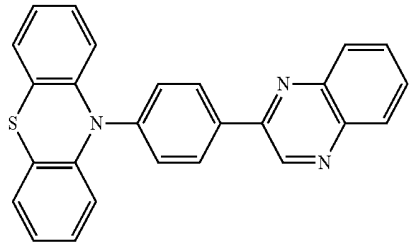

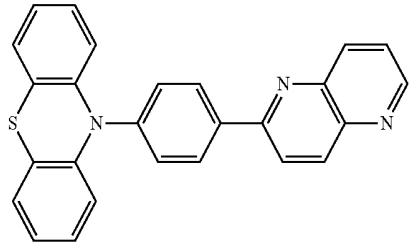

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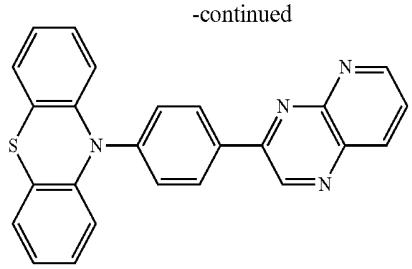
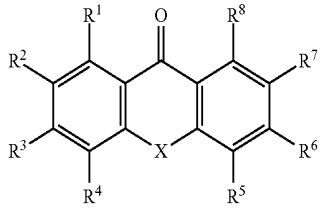


[0161] Examples of the preferred right-emitting material include the following compounds,

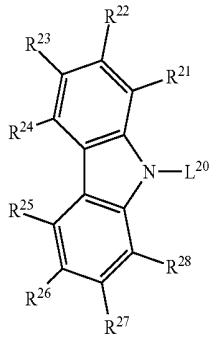
[0162] (1) A compound represented by the following general formula (261):

General Formula (261)

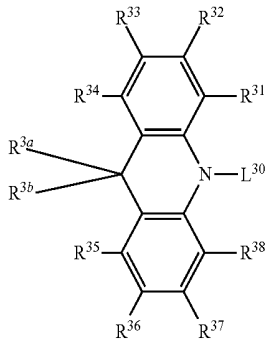


wherein in the general formula (261), X represents an oxygen atom or a sulfur atom; and R1 to R8 each independently represent a hydrogen atom or a substituent, provided that at least one of R1 to R8 each independently represent a group represented by any of the following formulae (262) to (266) and R^1 and R^2, R^2 and R^3, R^3 and R^4, R^5 and R^6, R^6 and R^7, R^7 and R^8 each may be bonded to each other to form a cyclic structure.

General Formula (262)



General Formula (263)



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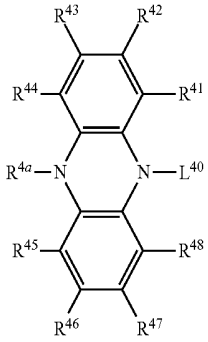
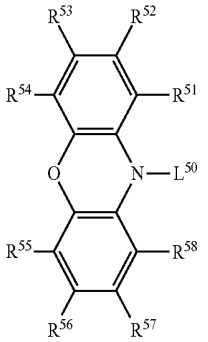
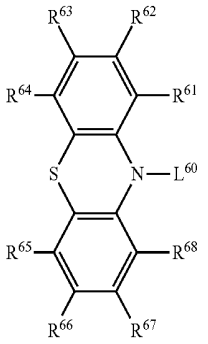
General Formula (264)



General Formula (265)



General Formula (266)



wherein in the general formulae (262) to (266), L^{20}, L^{30}, L^{40}, L^{50}, and L^{60} each independently represent a single bond or a divalent linking group, and the group is bonded to the cyclic structure of the general formula (261) through L^{20}, L^{30}, L^{40}, L^{50}, and L^{60}; and R^{21} to R^{28}, R^{31} to R^{38}, R^{3a} to R^{3b}, R^{41} to R^{48}, R^{4a}, R^{51} to R^{58}, and R^{61} to R^{68} each independently represent a hydrogen atom or a substituent, provided that R^{21} and R^{22}, R^{22} and R^{23}, R^{23} and R^{24}, R^{24} and R^{25}, R^{25} and R^{26}, R^{26} and R^{27}, R^{27} and R^{28}, R^{31} and R^{32}, R^{32} and R^{33}, R^{33} and R^{34}, R^{35} and R^{36}, R^{36} and R^{37}, R^{37} and R^{38}, R^{3a} and R^{3b}, R^{41} and R^{42}, R^{42} and R^{43}, R^{43} and R^{44}, R^{45} and R^{46}, R^{46} and R^{47}, R^{47} and R^{48}, R^{51} and R^{52}, R^{52} and R^{53}, R^{53} and R^{54}, R^{55} and R^{56}, R^{56} and R^{57}, R^{57} and R^{58}, R^{61} and R^{62}, R^{62} and R^{63}, R^{63} and R^{64}, R^{65} and R^{66}, R^{66} and R^{67}, and R^{67} and R^{68} each may be bonded to each other to form a cyclic structure.

[0163] (2) The compound according to the item (1), wherein In the general formula (261), at least one of R^3 and R^6 represents a group represented by any of the general formulae (262) to (266).

[0164] (3) The compound according to the item (2), wherein in the general formula (261), R^3 and R^6 each represent a group represented by any of the general formulae (262) to (266).

[0165] (4) The compound according to the item (2), wherein in the general formula (261), at least one of R^3 and R^6 represents a group represented by the general formula (263).

[0166] (5) The compound according to the item (2), wherein in the general formula (261), at least one of R^3 and R^6 represents a group represented by the general formula (262).

[0167] (6) The compound according to any one of the items (1) to (5), wherein in the general formulae (262) to (266), at least one of R^{21} to R^{28}, R^{31} to R^{38}, R^{41} to R^{48}, R^{51} to R^{58}, and R^{61} to R^{68} represents a substituent.

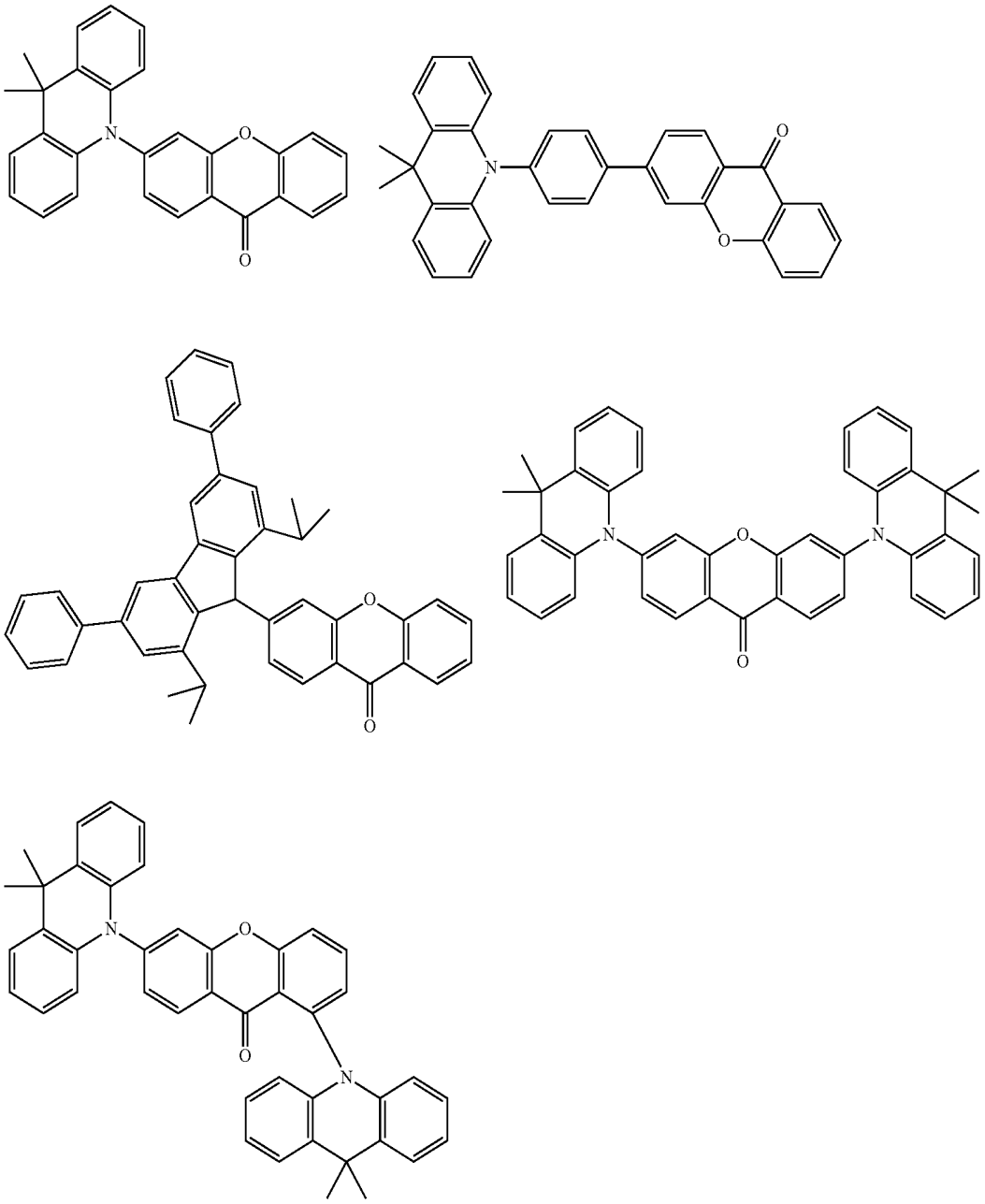
[0168] (7) The compound according to the item (6), wherein in the general formulae (262) to (266), at least one of R^{23}, R^{26}, R^{33}, R^{36}, P^{43}, R^{46}, R^{53}, R^{56}, R^{63}, and R^{66} represents a substituent.

[0169] (8) The compound according to the item (7), wherein the substituent is a group represented by any of general formulae (262) to (266).

[0170] (9) The compound according to any one of the items (1) to (8), wherein in the general formulae (262) to (266), L represents a single bond.

[0171] (10) The compound according to any one of the items (1) to (9), wherein in the general formula (261), X represents an oxygen atom.

[0172] Examples of the compound include the following compounds.



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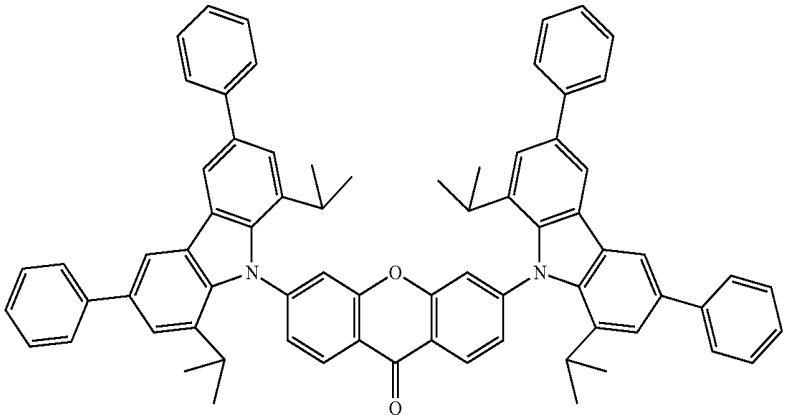

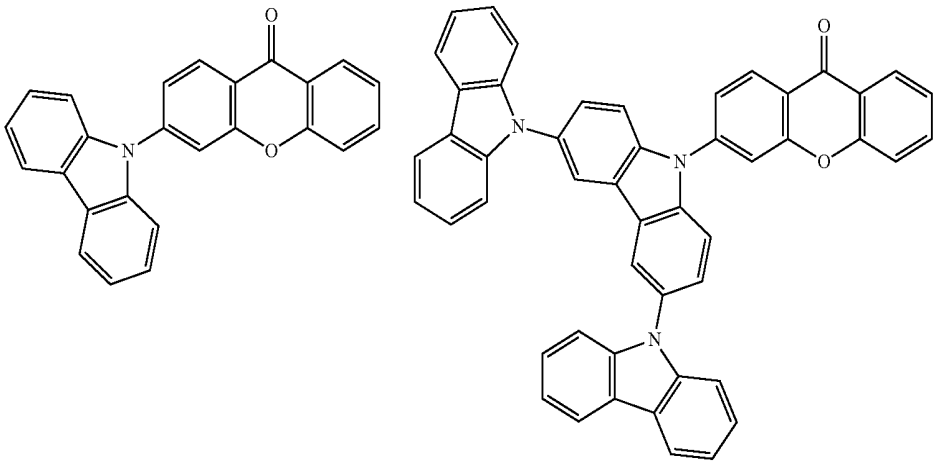

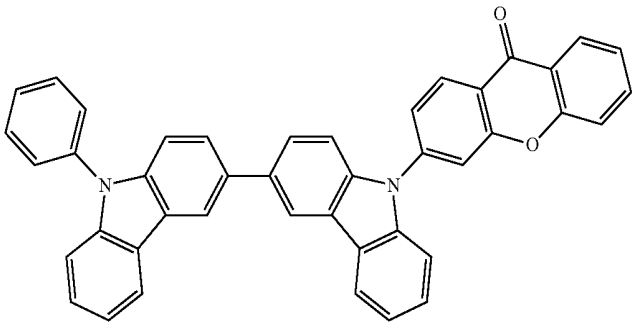

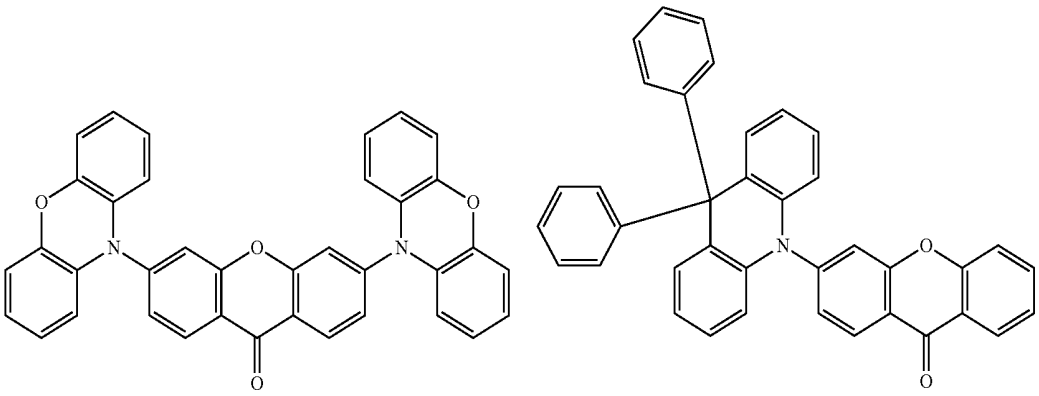

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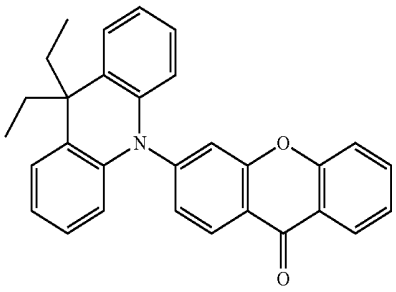

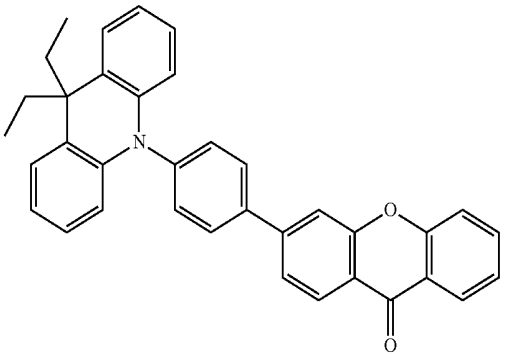

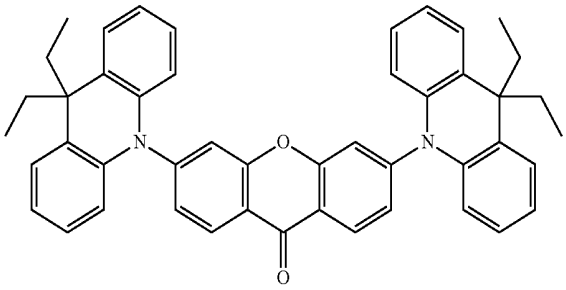

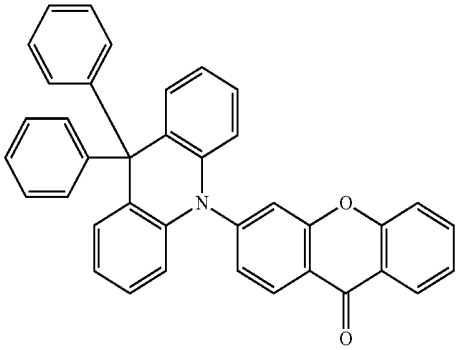

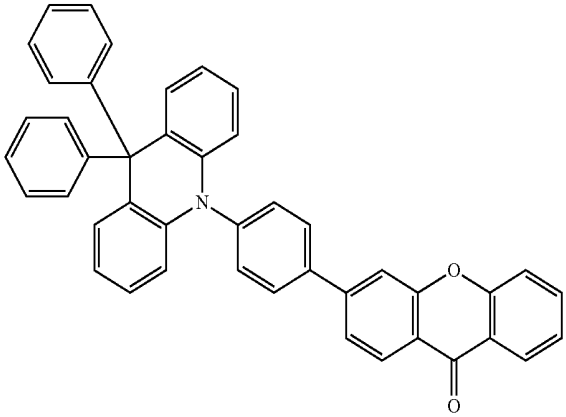

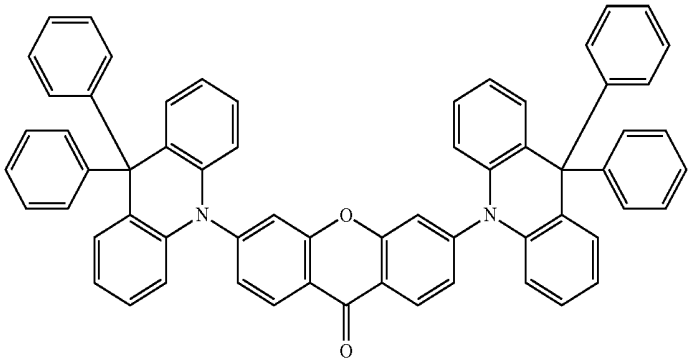

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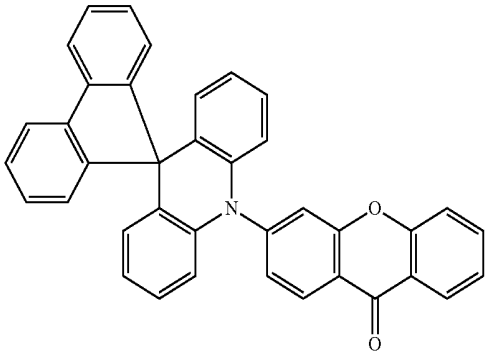

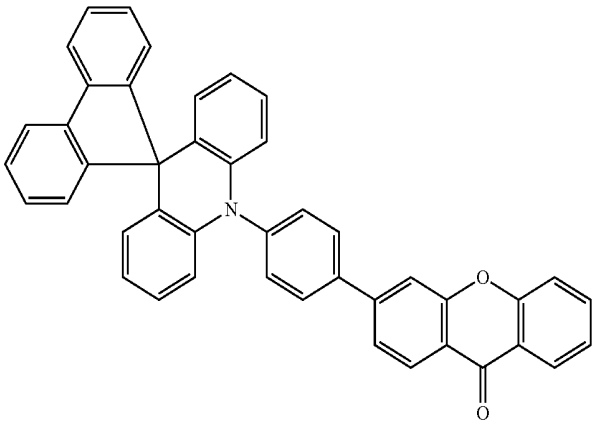

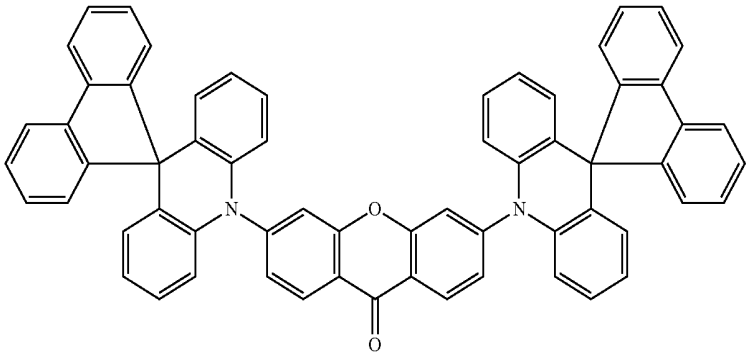

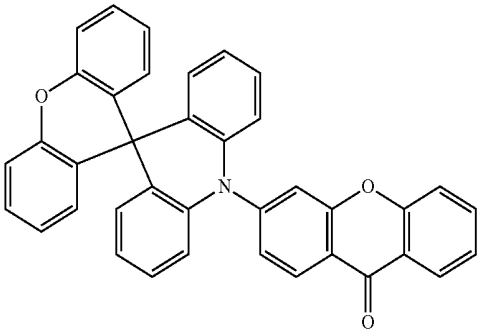

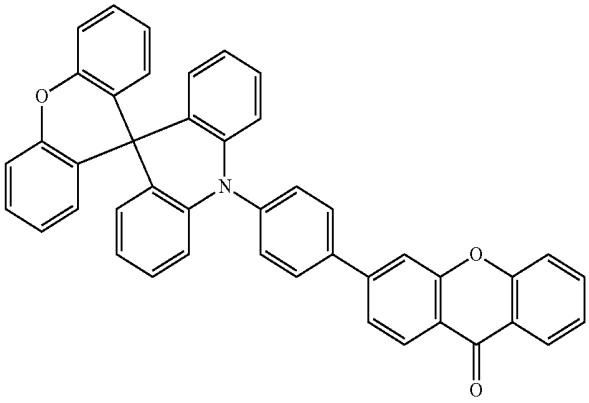

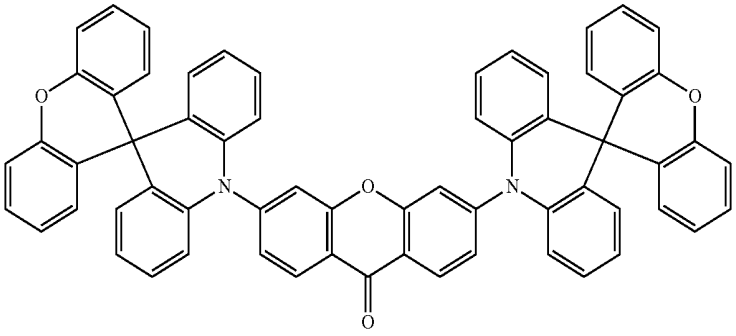

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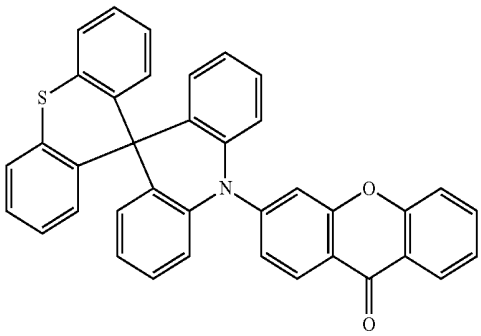

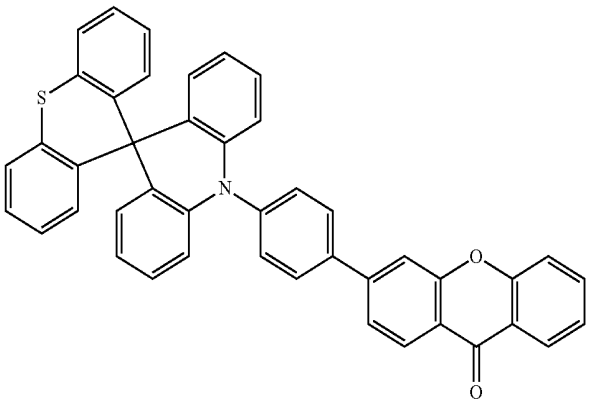

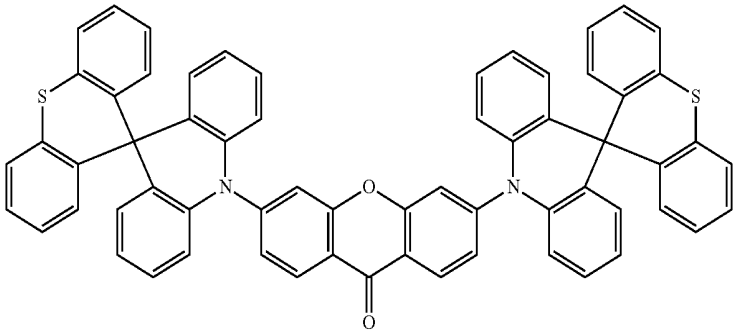

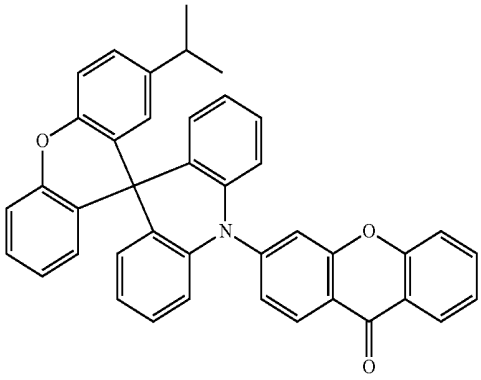

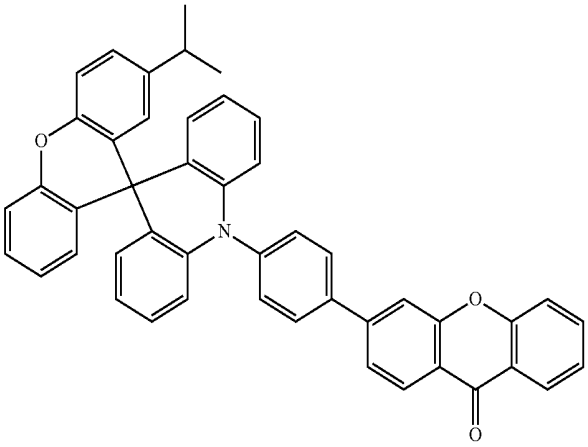

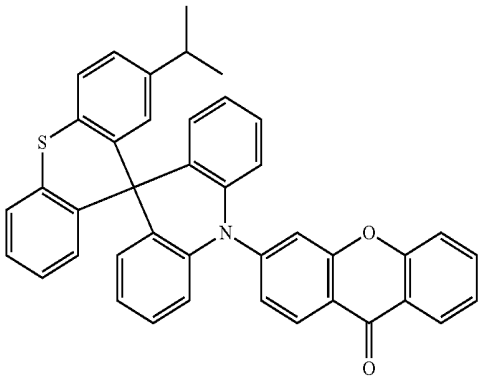

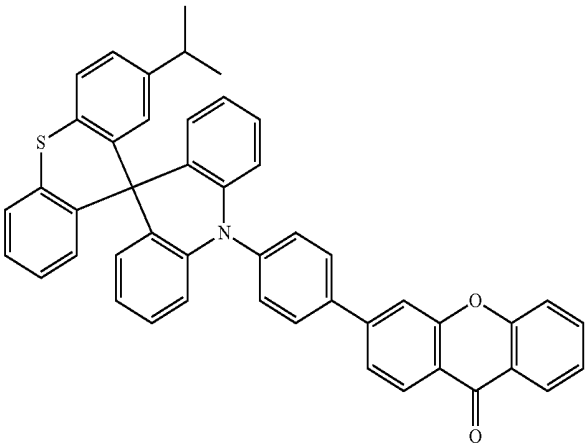

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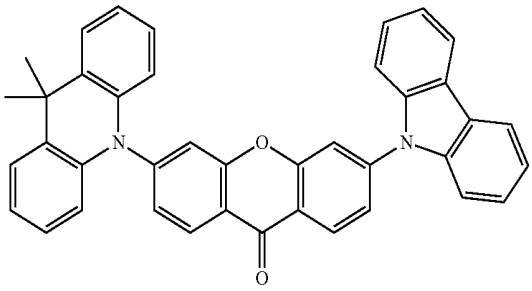

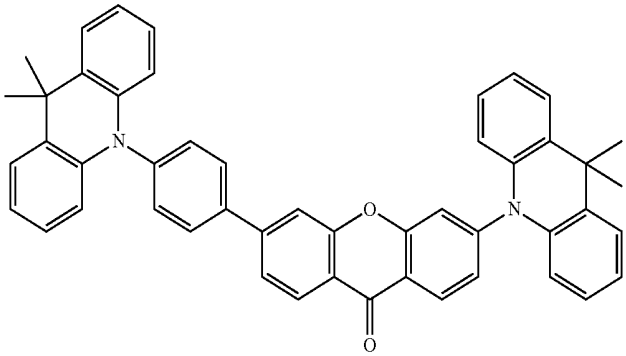

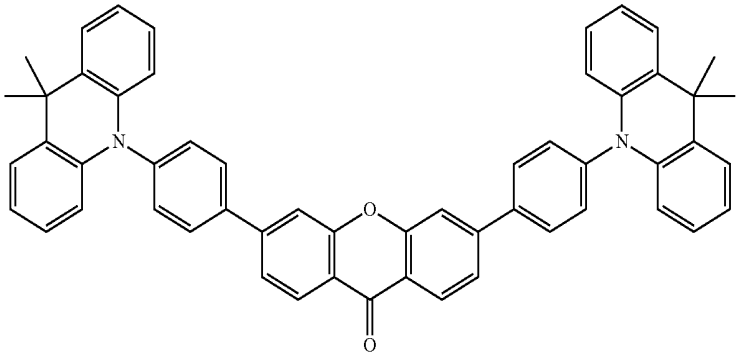

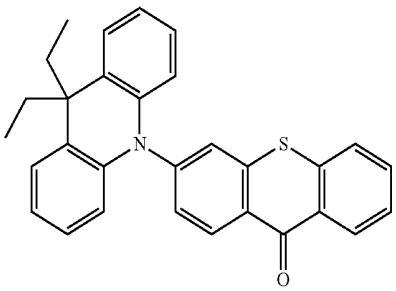

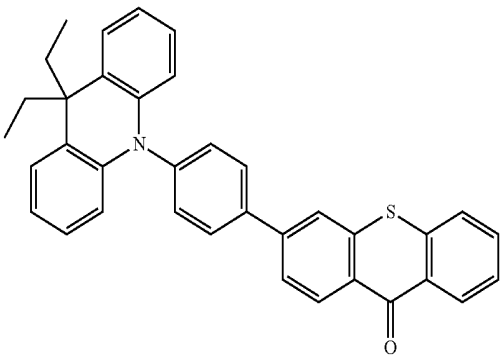

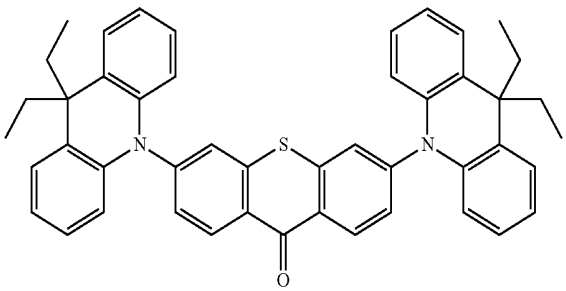

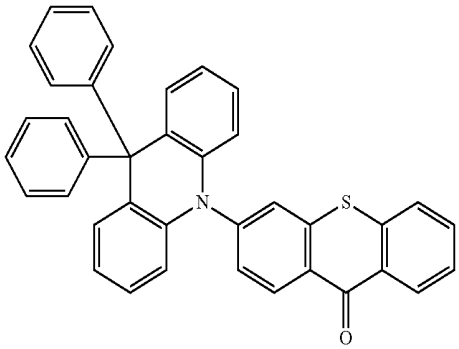

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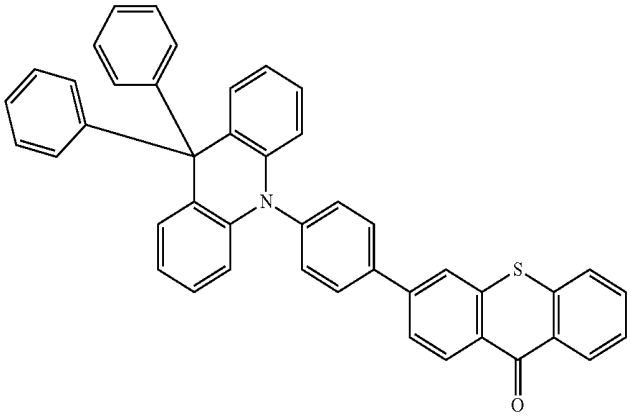
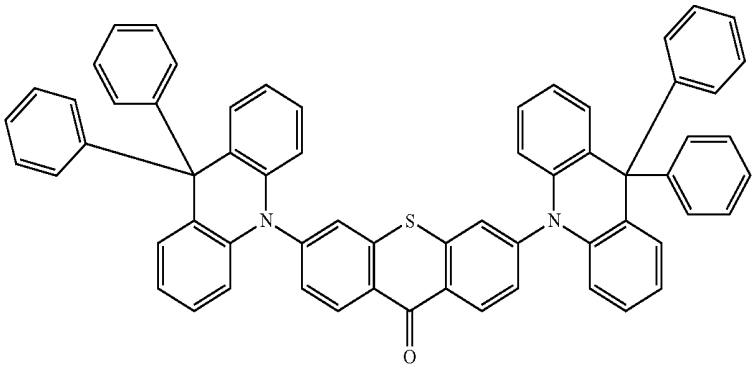
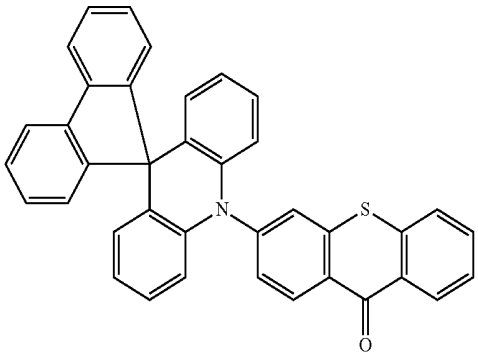
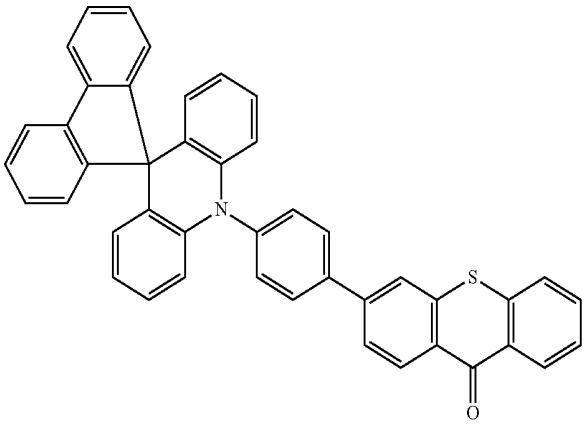
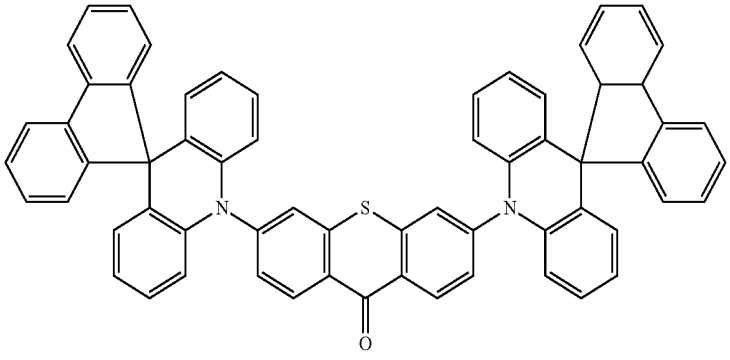

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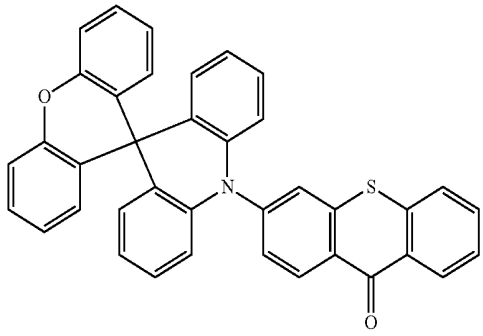
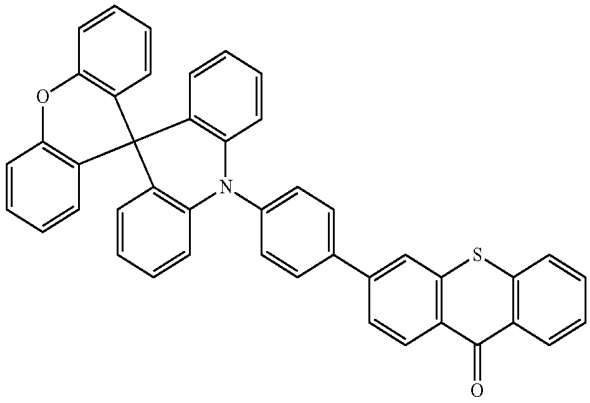
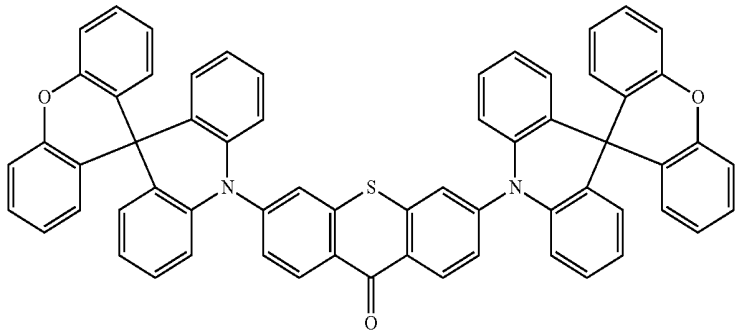
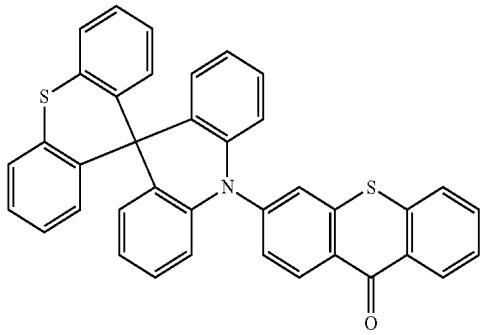
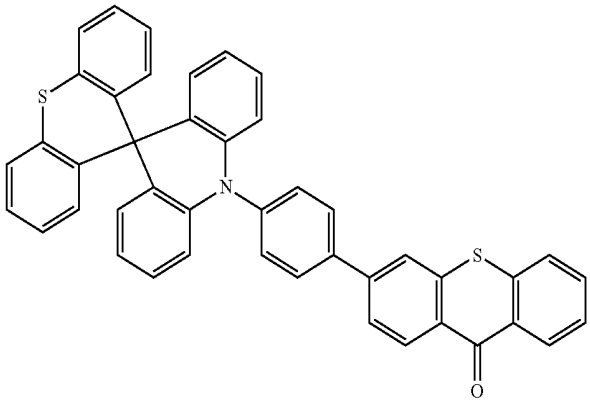
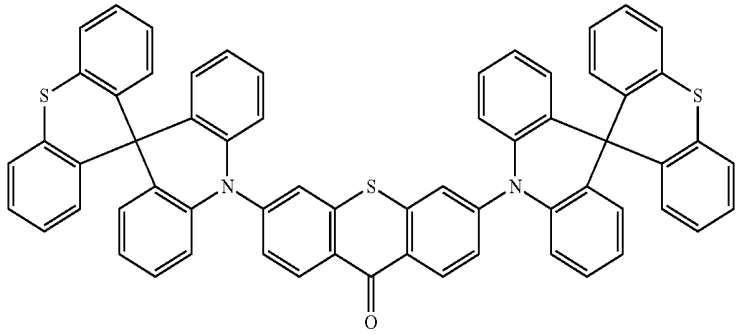

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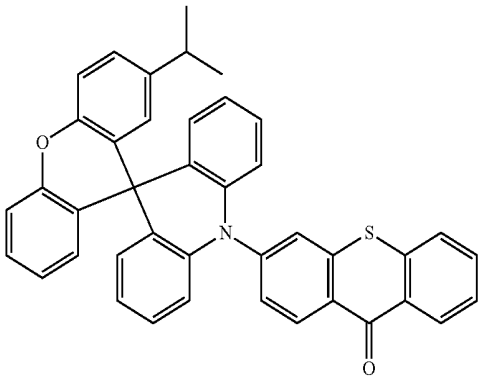

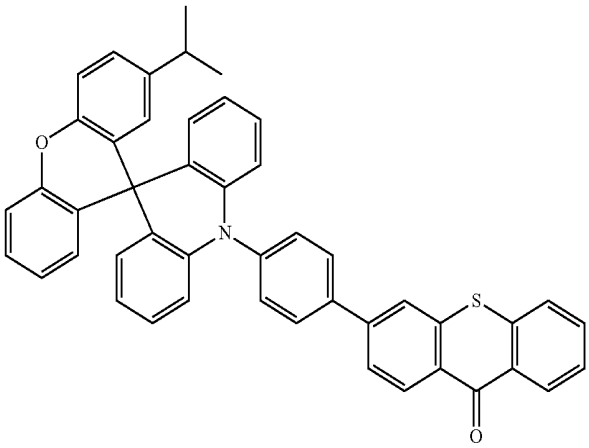

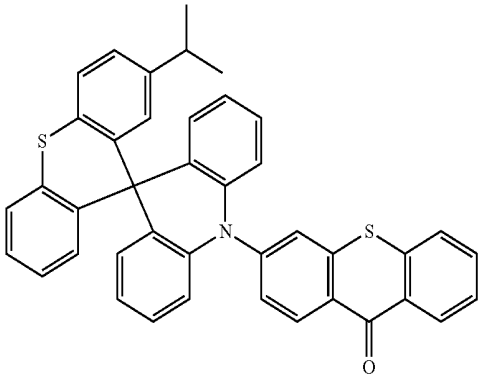

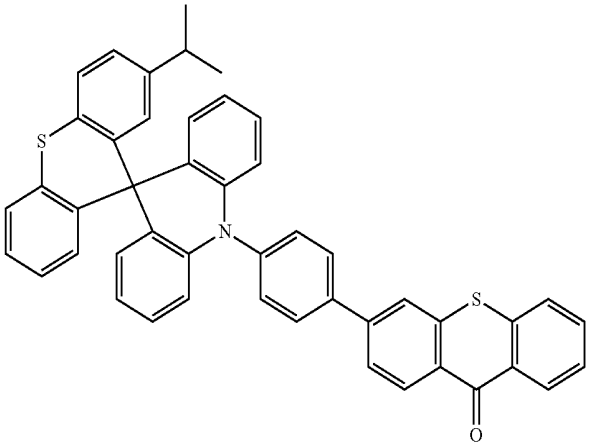

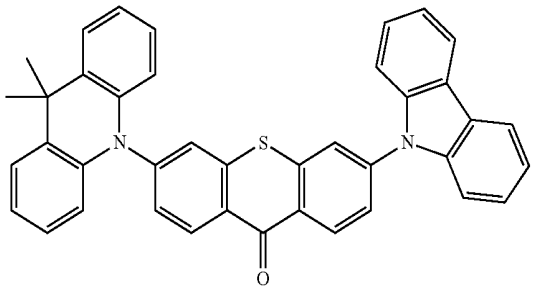

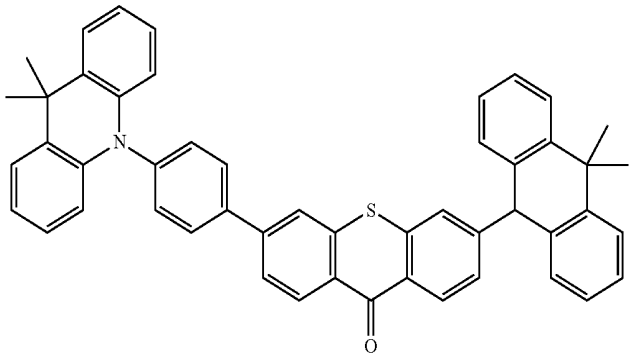

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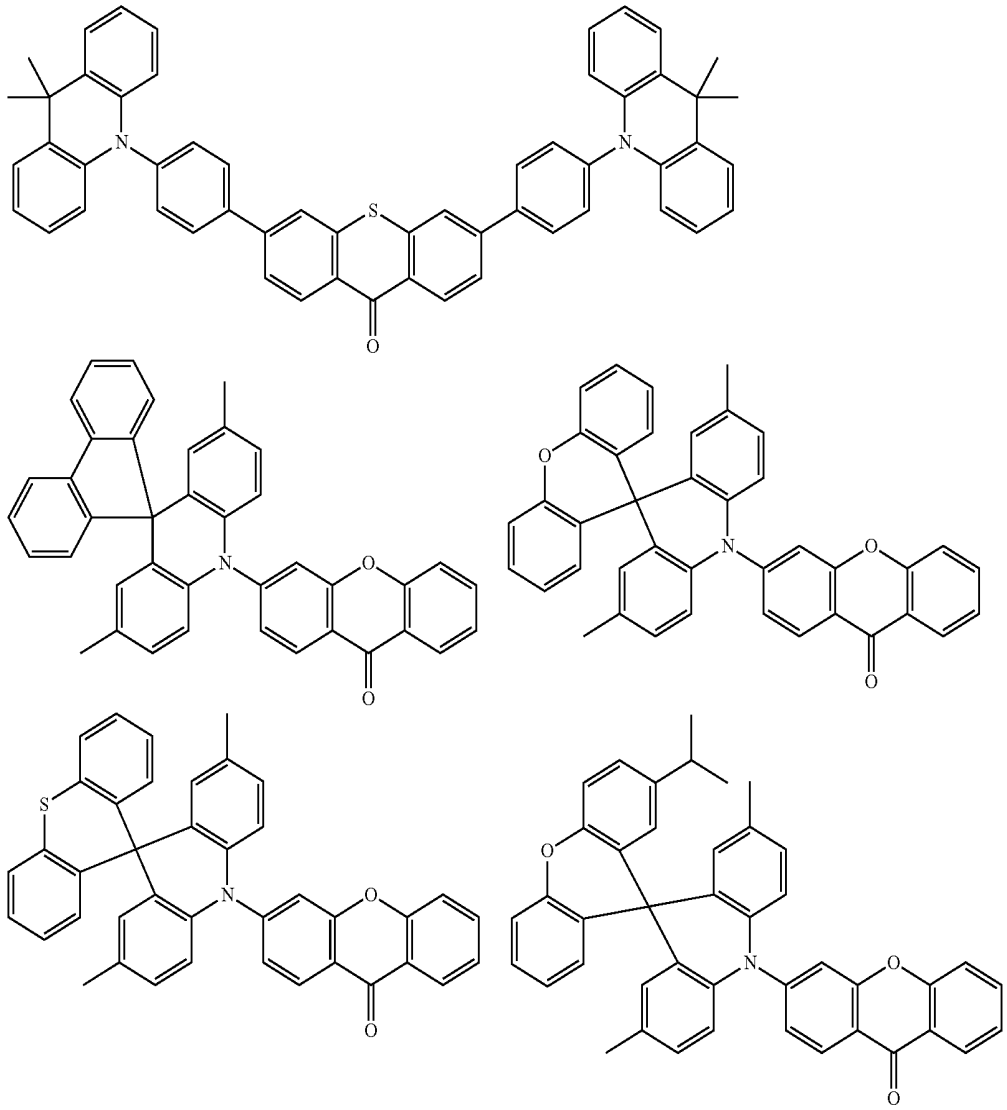
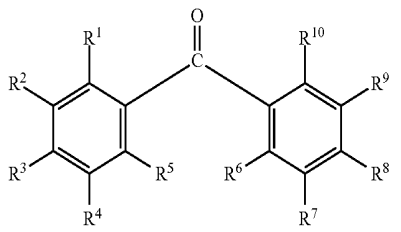


[0173] Examples of the preferred light-emitting material include the following compounds.

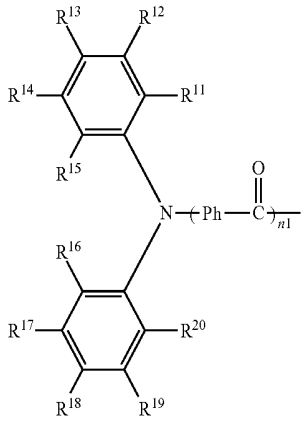
[0174] (1) A compound represented by the following general formula (271):

General Formula (271)



wherein in the general formula (211), R^1 to R^{10} each independently represent a hydrogen atom or a substituent, provided that at least one of R^1 to R^{10} each independently represent a group represented by the following general formula (272), and R^1 and R^2, R^2 and R^3, R^3 and R^4, R^4 and R^5, R^6 and R^7, R^7 and R^8, R^8 and R^9, and R^9 and R^{10} each may be bonded to each other to form a cyclic structure:

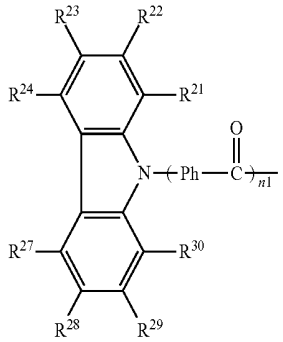
General Formula (272)



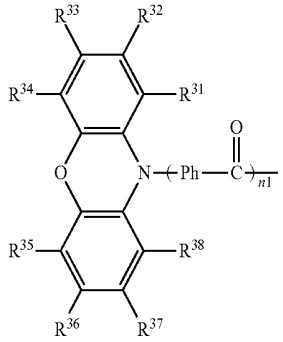
wherein, in the general formula (272), R^{11} to R^{20} each independently represent a hydrogen atom or a substituent, in which R^{11} and R^{12}, R^{12} and R^{13}, R^{13} and R^{14}, R^{14} and R^{15}, R^{15} and R^{16}, R^{16} and R^{17}, R^{17} and R^{18}, R^{18} and R^{19}, and R^{19} and R^{20} each may be bonded to each other to form a cyclic structure; Ph represents a substituted or unsubstituted phenylene group; and n1 represents 0 or 1.

[0175] (2) The compound according to the item (1), wherein the group represented toy the general formula (272) is a group represented toy any one of the following general formulae (273) to (275):

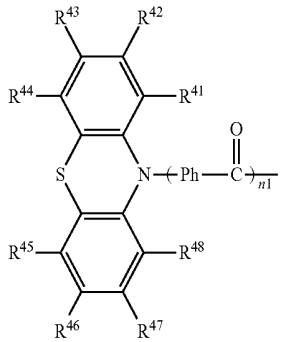
General Formula (273)



General Formula (274)



General Formula (275)



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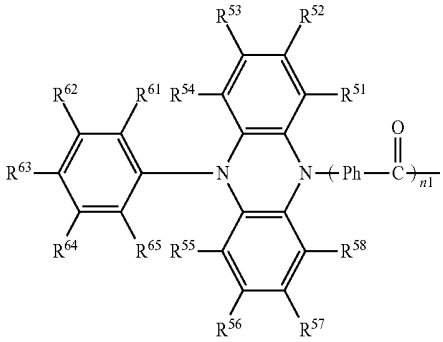
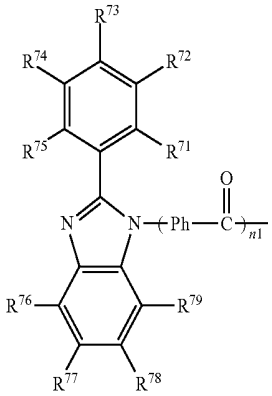
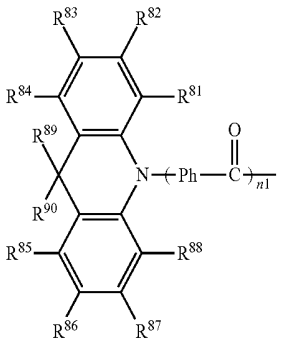
General Formula (276)



General Folrmula (277)



General Formula (278)



wherein in the general formulae (273) to (278), R^{21} to R^{24}, R^{27} to R^{28}, R^{41} to R^{48}, R^{51} to R^{54}, R^{61} to R^{65}, R^{71} to R^{79}, R^{81} to R^{90} each independently represent a hydrogen atom or a substituent, in which R^{21} and R^{22}, R^{22} and R^{23}, R^{23} and R^{24}, R^{27} and R^{28}, R^{28} and R^{29}, R^{29} and R^{30}, R^{31} and R^{32}, R^{32} and R^{33}, R^{33} and R^{34}, R^{35} and R^{36}, R^{36} and R^{37}, R^{37} and R^{38}, R^{41} and R^{42}, R^{42} and R^{43}, R^{43} and R^{44}, R^{45} and R^{46}, R^{46} and R^{47}, R^{47} and R^{48}, R^{51} and R^{52}, R^{52} and R^{53}, R^{53} and R^{54}, R^{55} and R^{56}, R^{56} and R^{57}, R^{57} and R^{58}, R^{61} and R^{62}, R^{62} and R^{63}, R^{63} and R^{64}, R^{64} and R^{65}, R^{54} and R^{61}, R^{55} and R^{65}, R^{71} and R^{73}, R^{72} and R^{73}, R^{73} and R^{74}, R^{74} and R^{75}, R^{76} and R^{77}, R^{77} and R^{78}, R^{78} and R^{79}, R^{81} and R^{82}, R^{82} and R^{83}, R^{83} and R^{84}, R^{85} and R^{86}, R^{86} and R^{87}, R^{87} and R^{88}, and R^{89} and R^{90} each may be bonded to each other to form a cyclic structure; and Ph represent a substituted or unsubstituted phenylene group; and n1 represents 0 or 1.

[0176] (3) The compound according to the item (1) or (2), wherein in the general formula (271), at least one of R^1 to R^5 and at least one of R^6 to R^{10} each represent a group represented by the general formula (272).

[0177] (4) The compound according to the item (3), wherein in the general formula (271), R^3 and R^8 each represent, ft group represented by the general formula (272).

[0178] (5) The compound according to any one or the items (1) to (4), wherein the group represented by the general formula (272) is a group represented by the general formula (274).

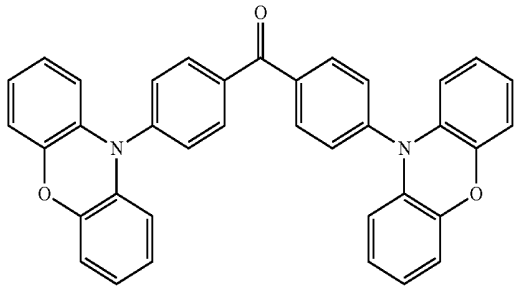
[0179] (6) The compound according to any one of the items (1) to (4), wherein the group represented by the general formula (272) is a group represented by the general formula (273).

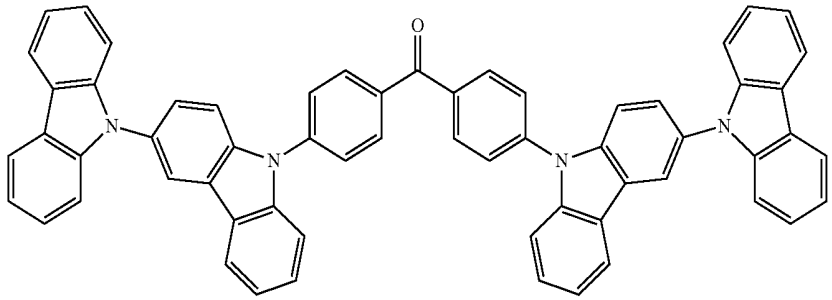
[0180] (7) The compound according to the item (6), wherein in the general formula (273), at least one of R^{21} to R^{24} and R^{27} to R^{30} represents a substituent.

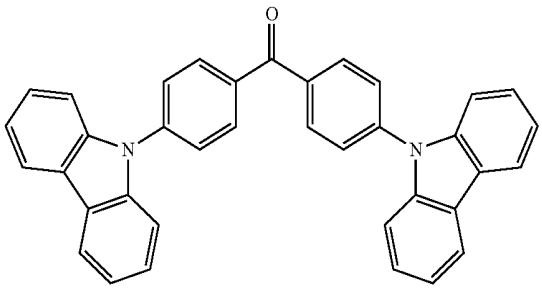
[0181] (8) The compound according to the item (7), wherein the substituent is a group represented by any one of the general formulae (273) to (278).

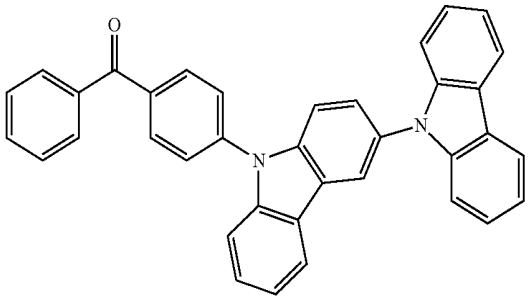
[0182] (9) The compound according to the item (8), wherein in the general formula (273), at least one of R^{23} and R^{28} represents the substituent.

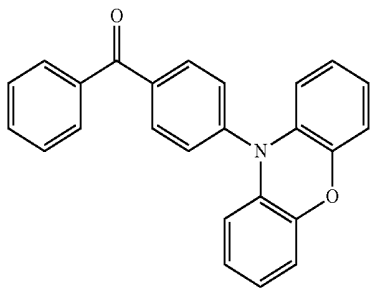
[0183] Examples of the compound include the following compounds.











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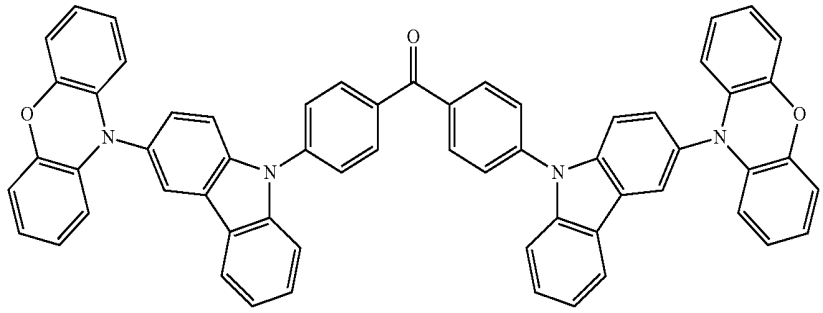

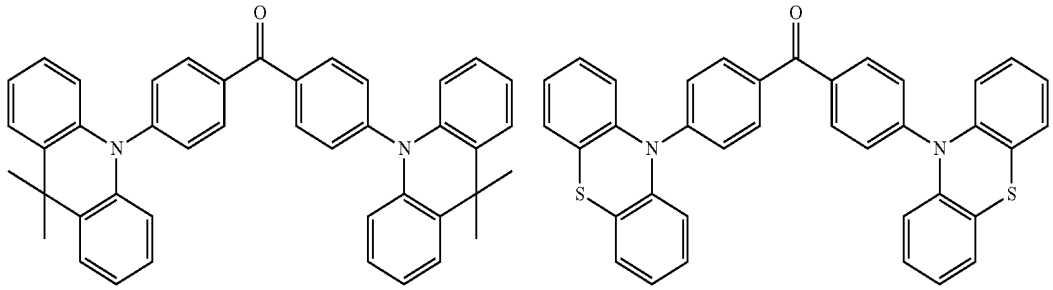

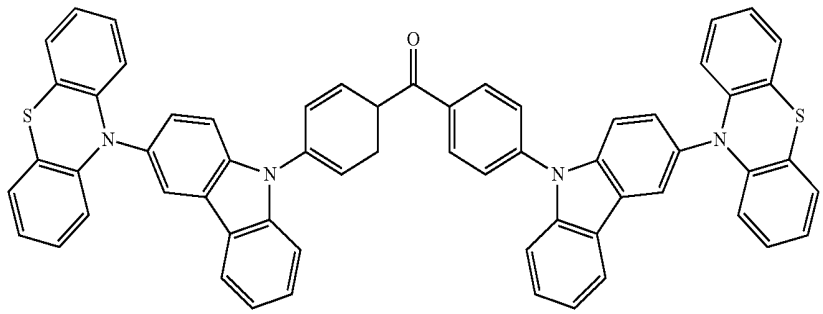

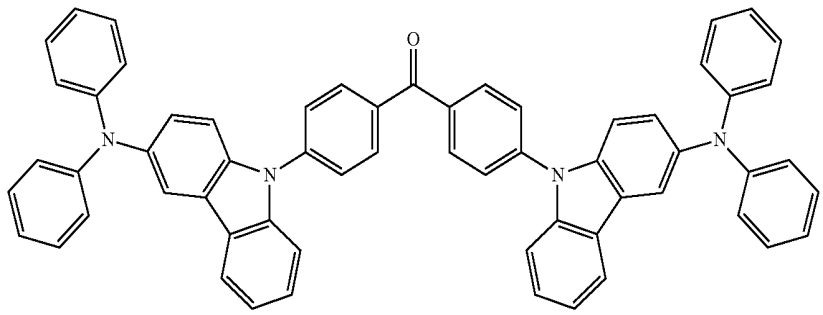

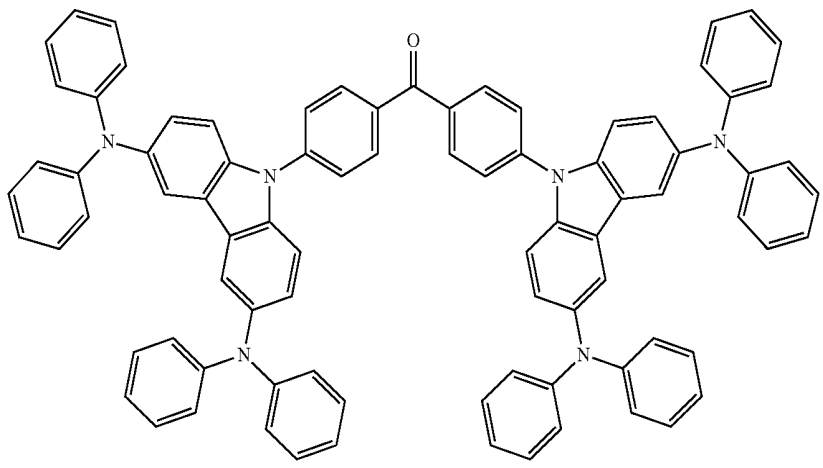

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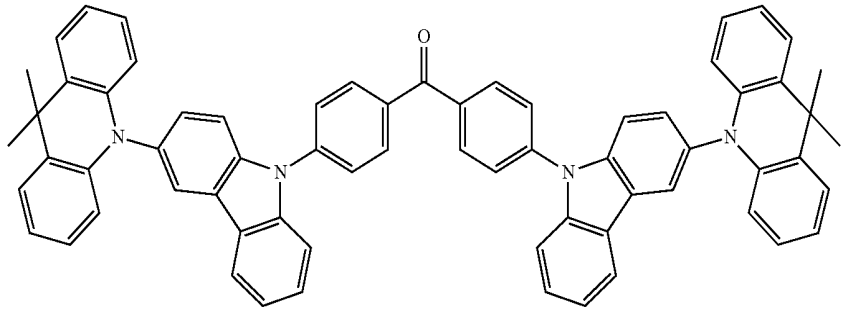

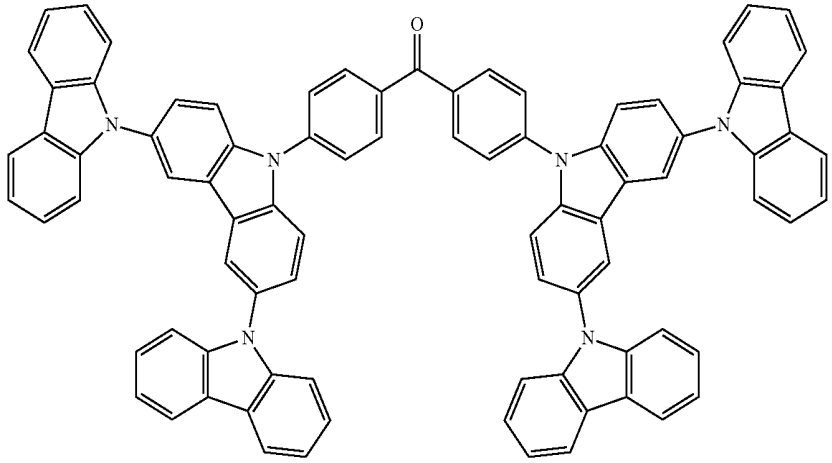

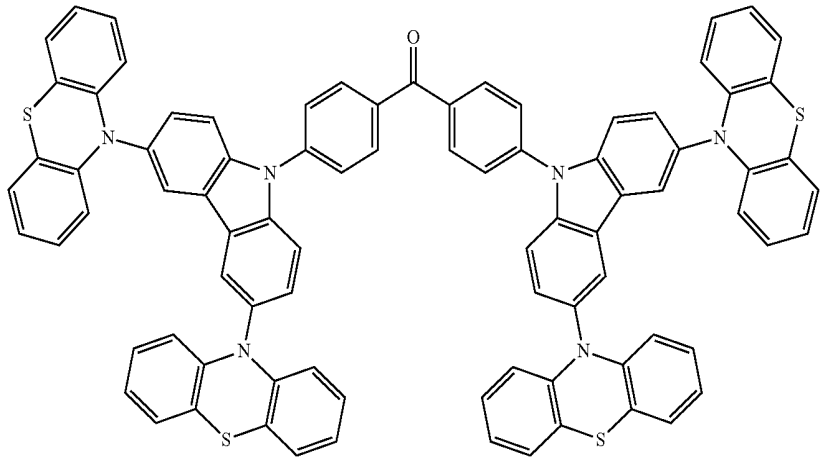

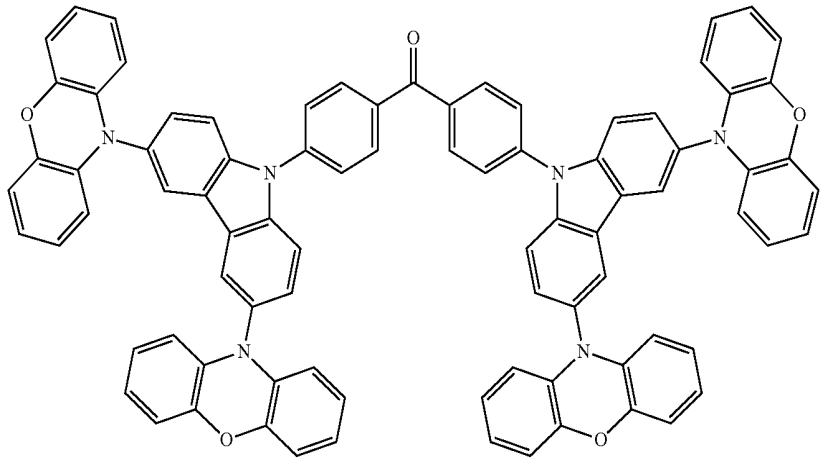

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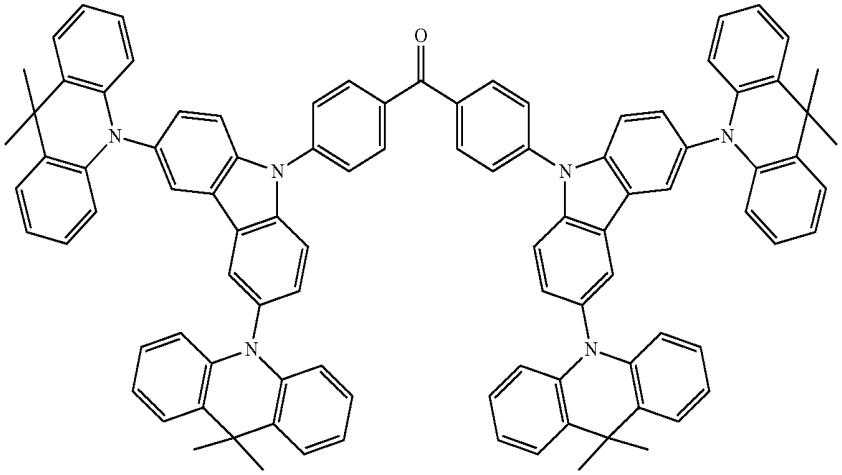

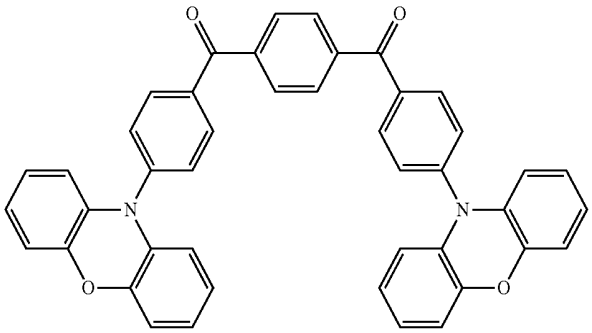

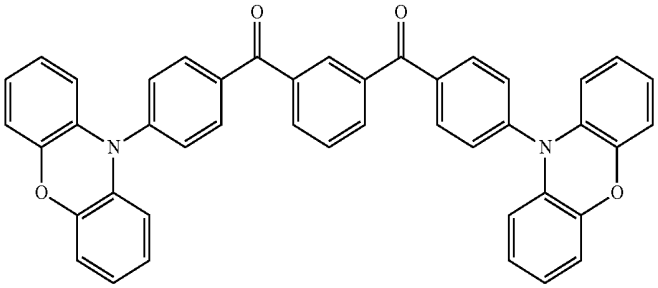

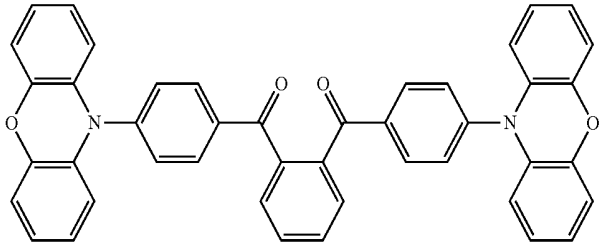

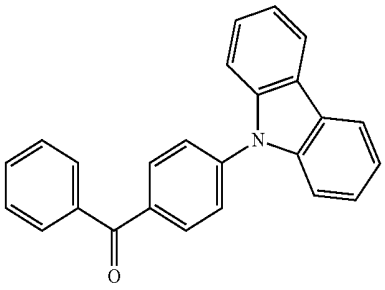

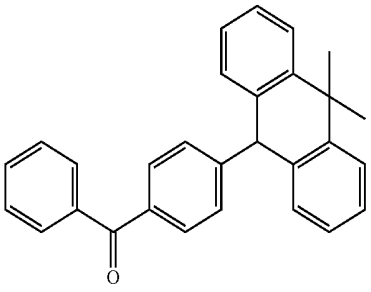

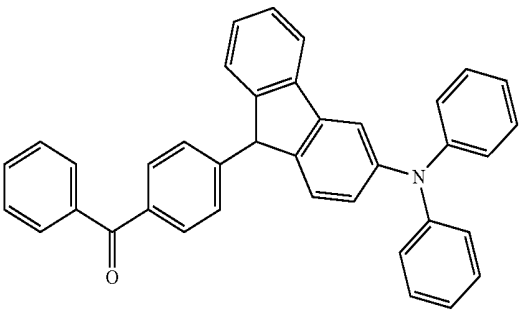

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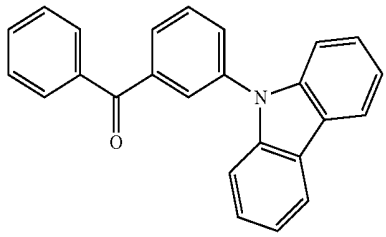
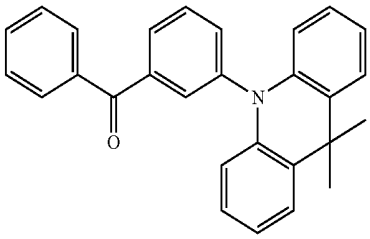
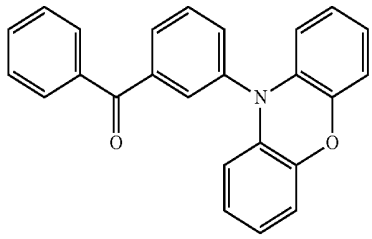
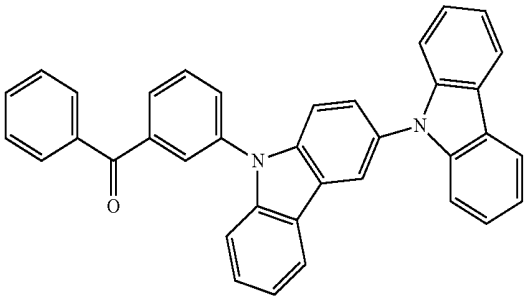
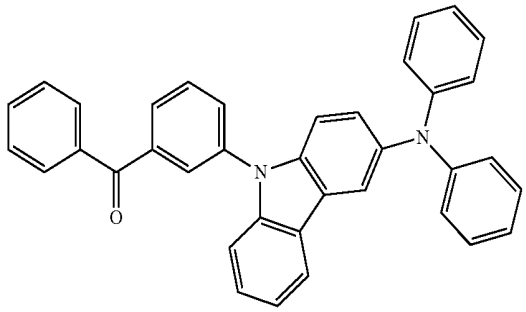
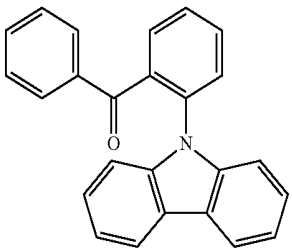
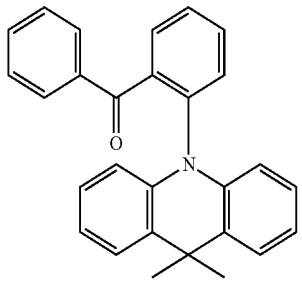
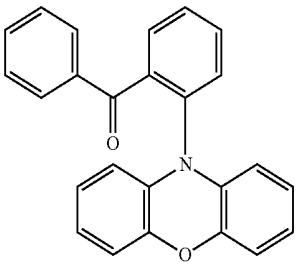
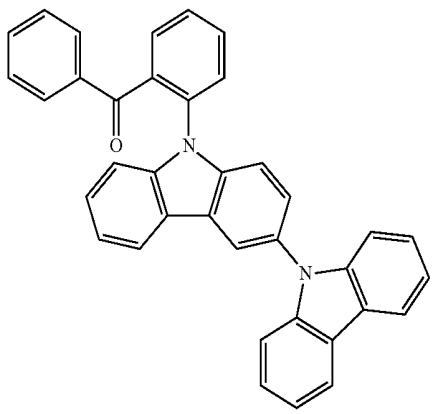
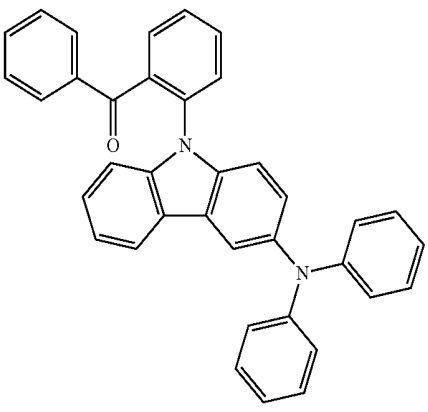

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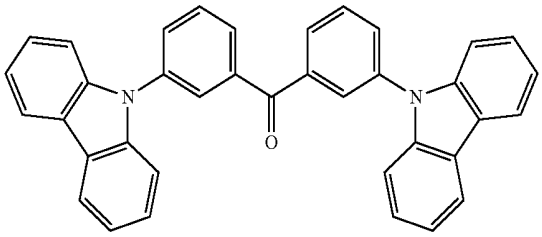

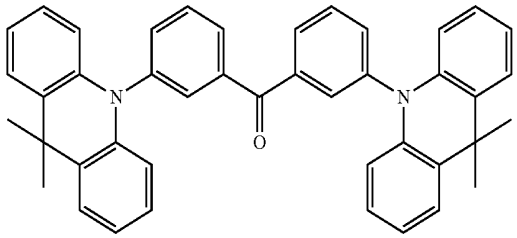

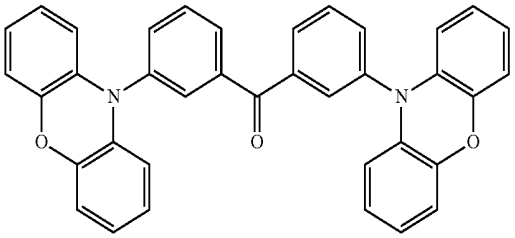

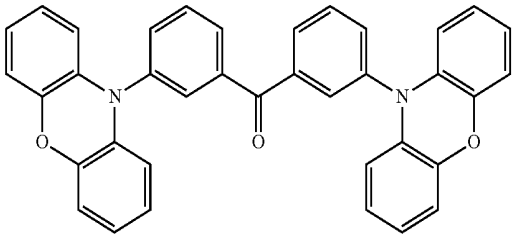

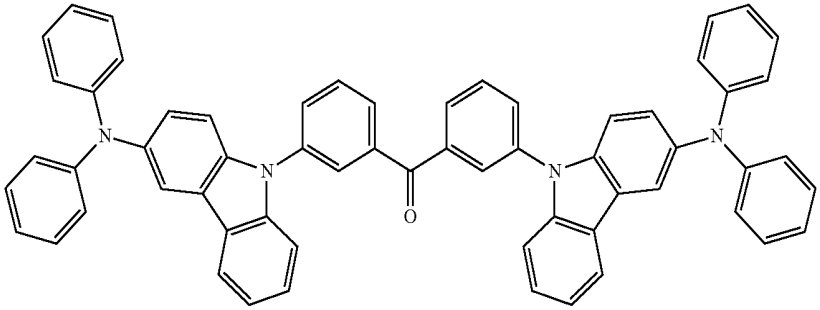

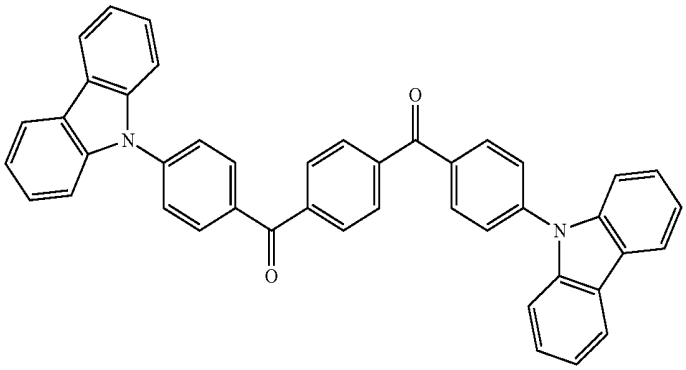

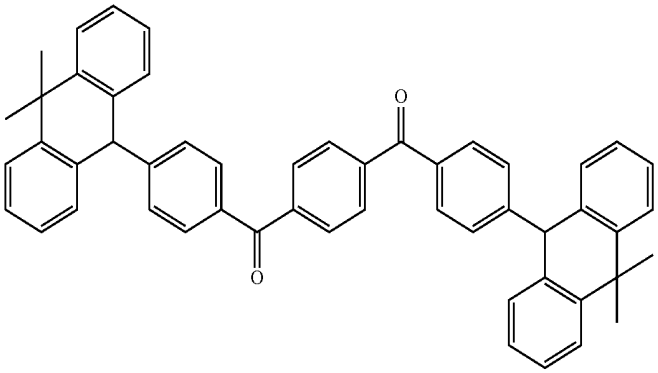

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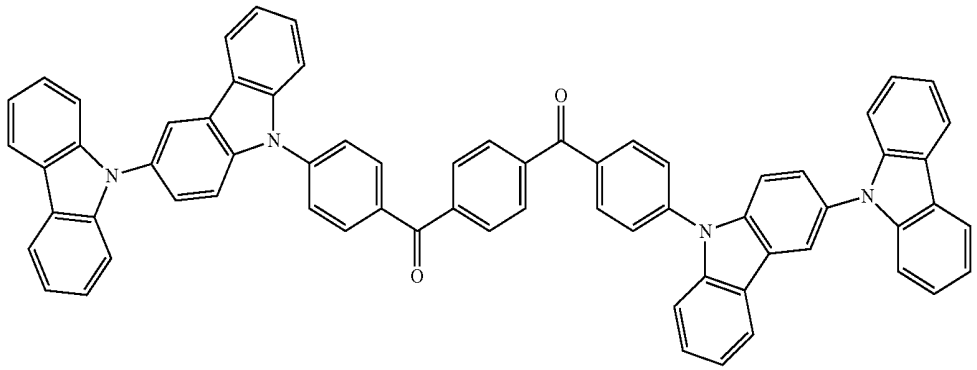

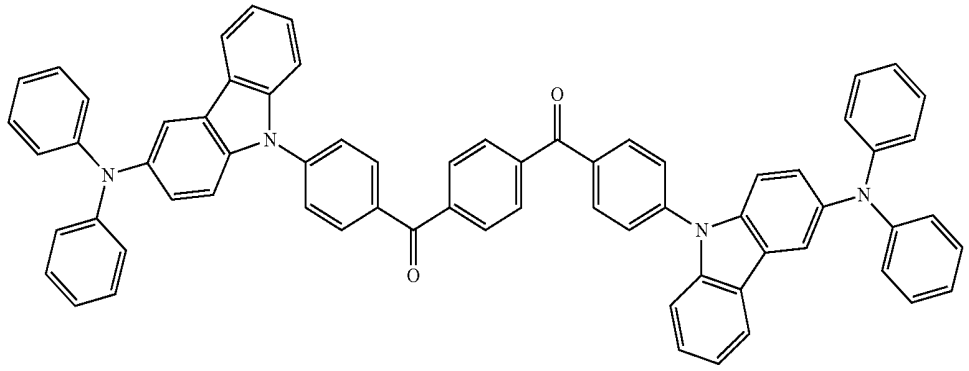

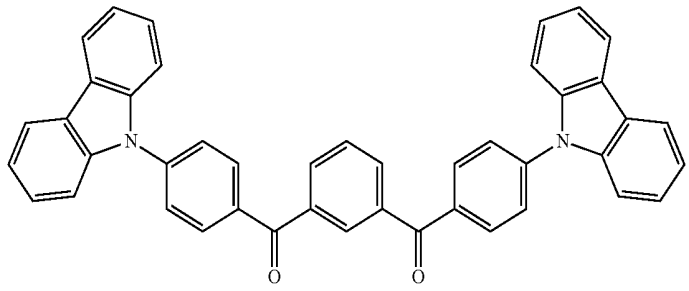

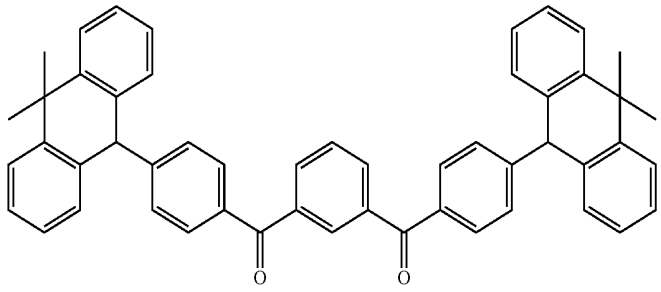

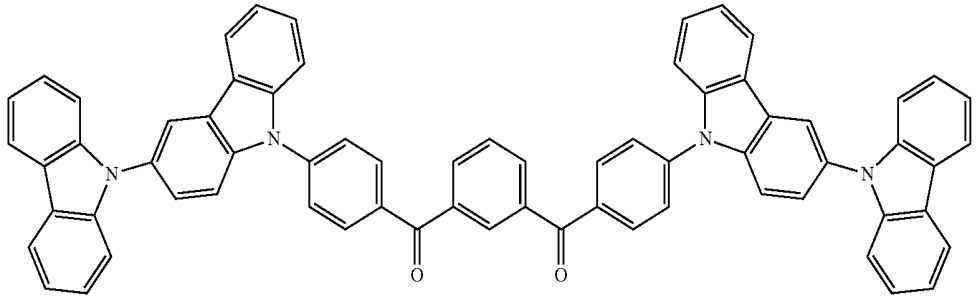

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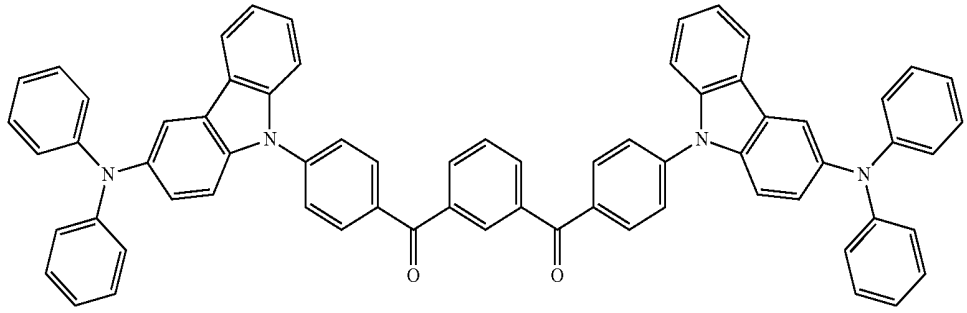

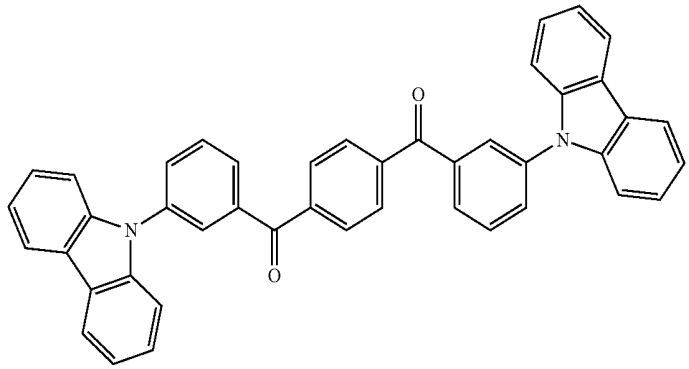

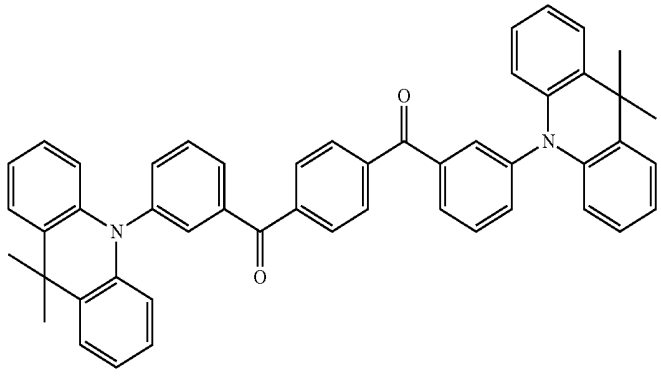

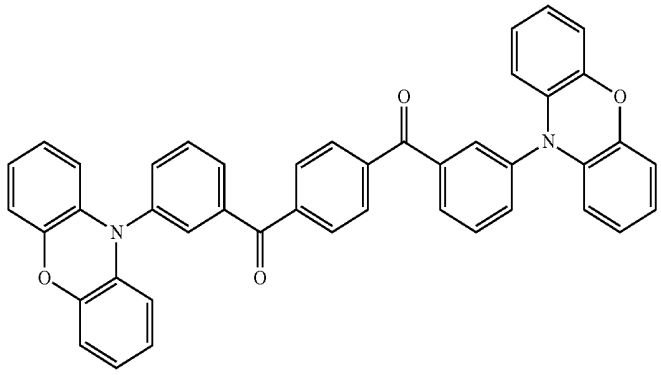

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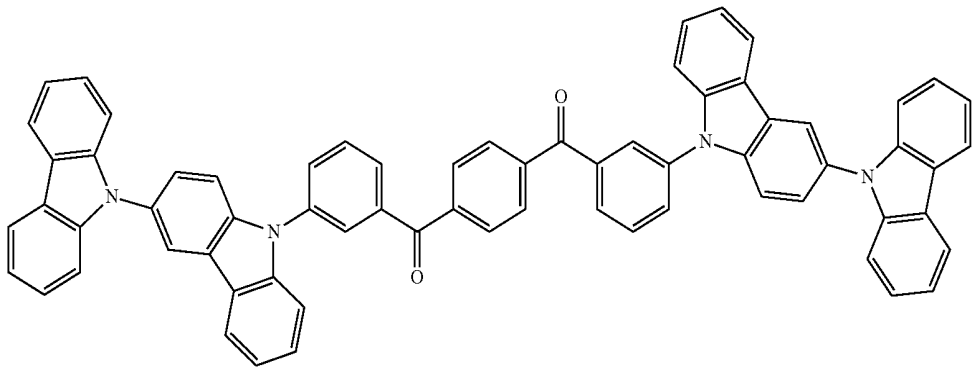

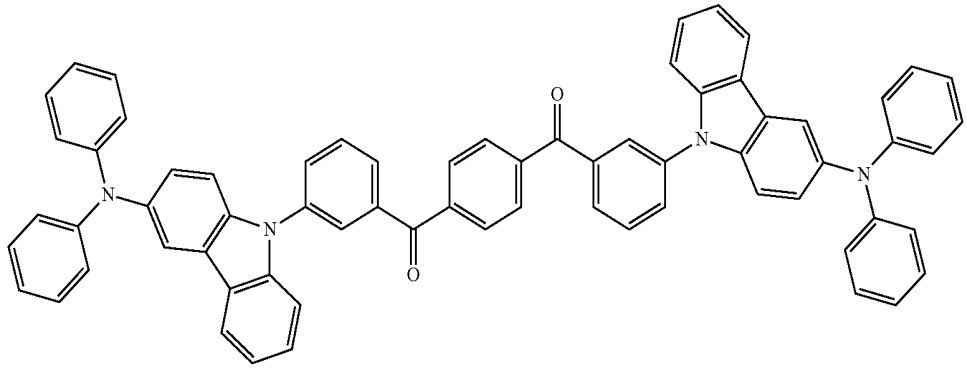

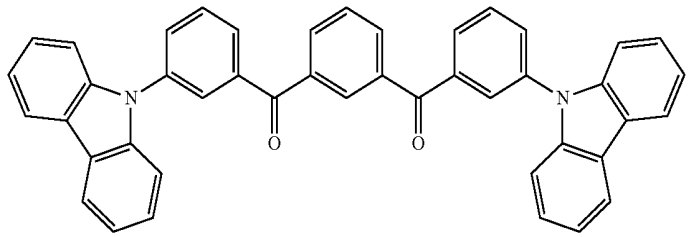

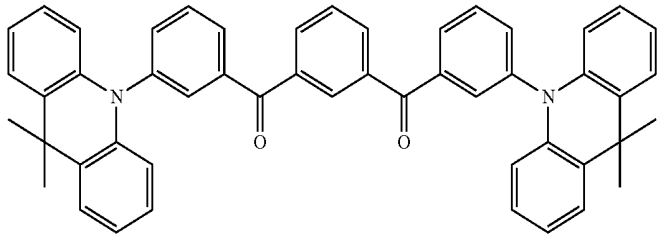

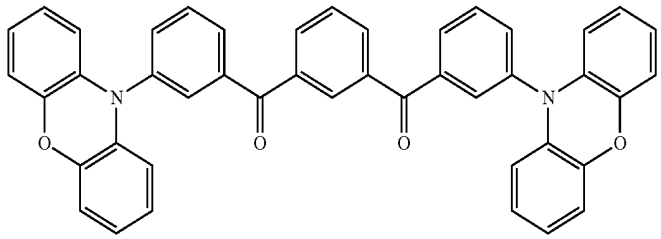

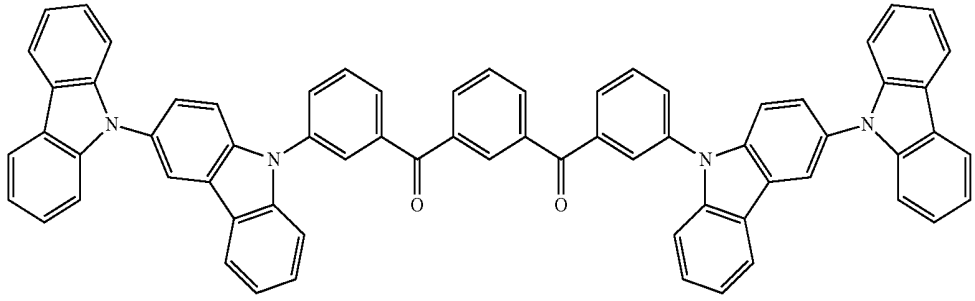

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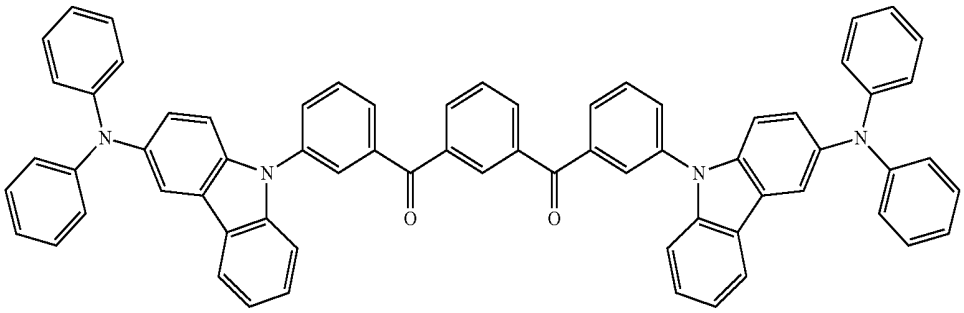

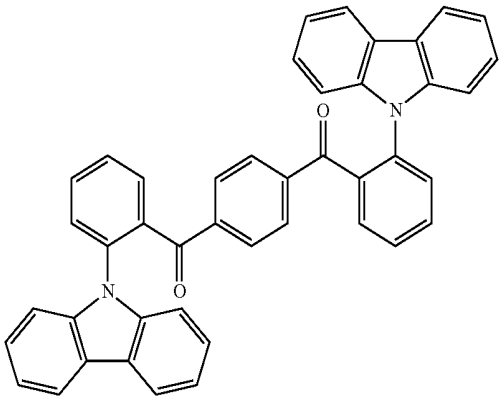

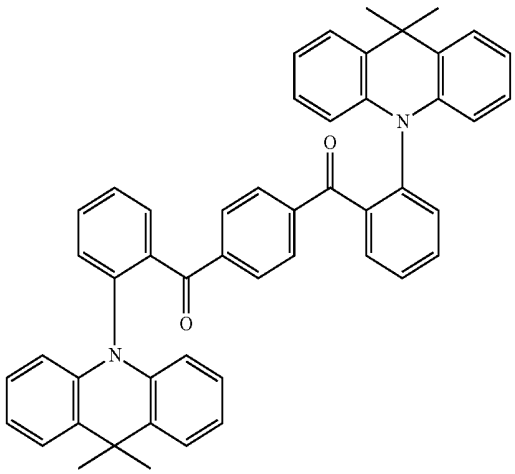

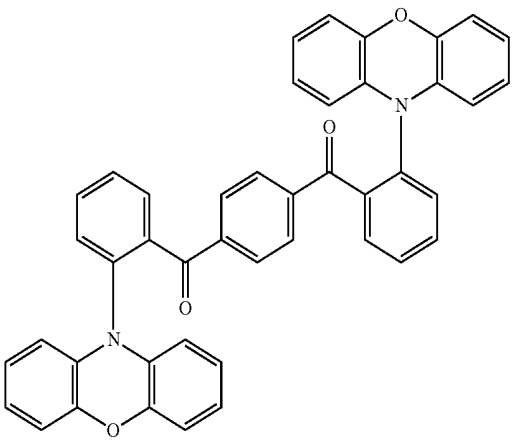

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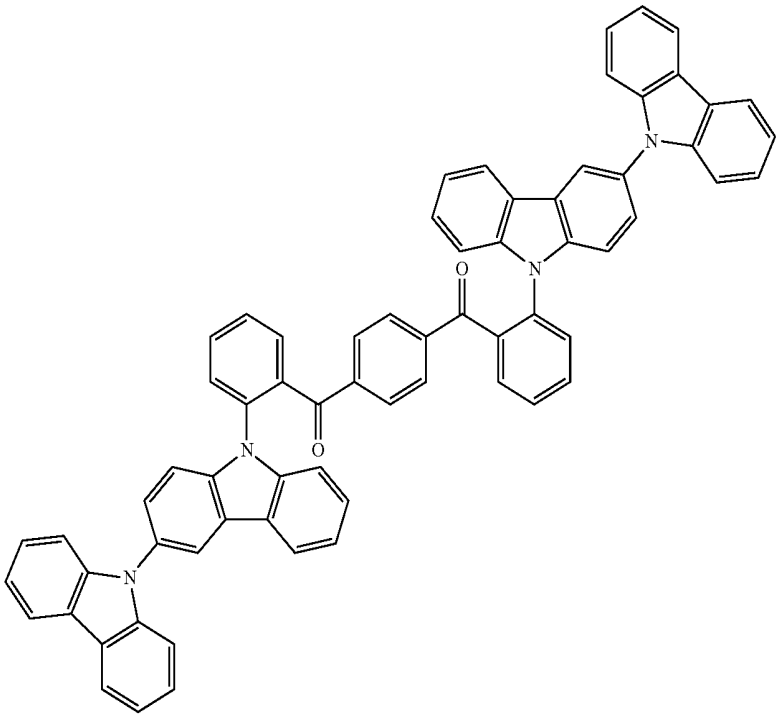

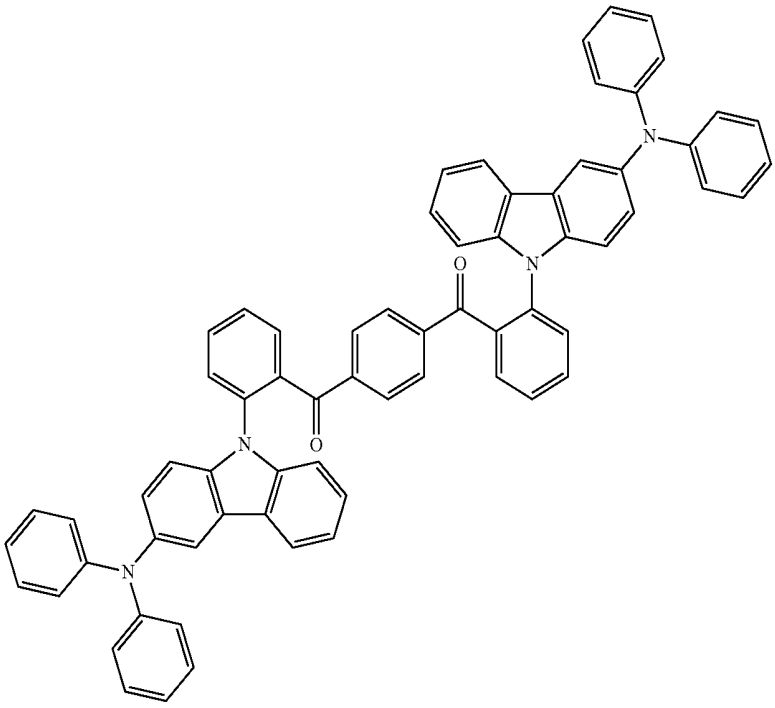

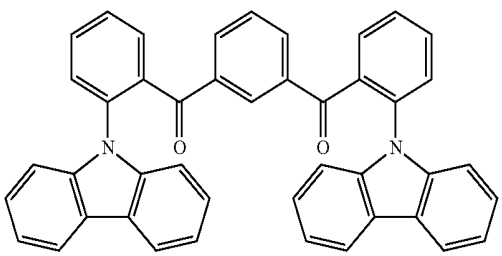

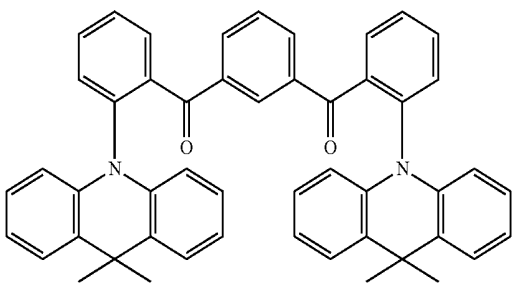

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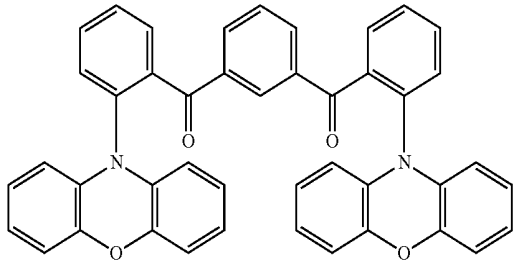

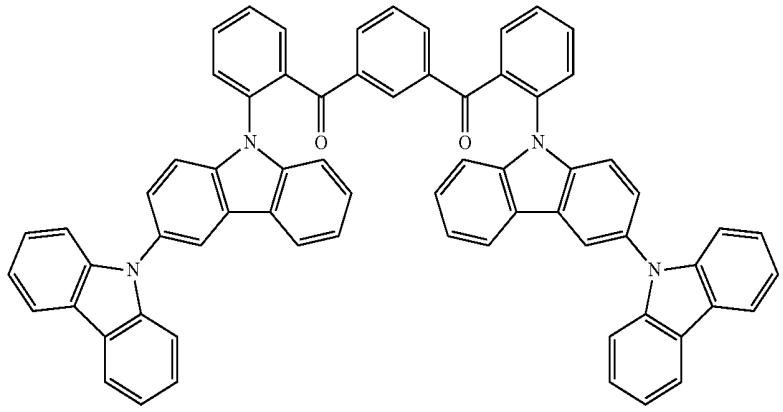

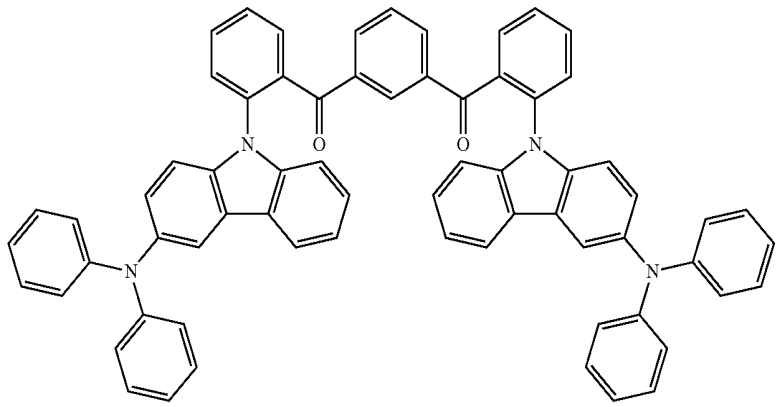

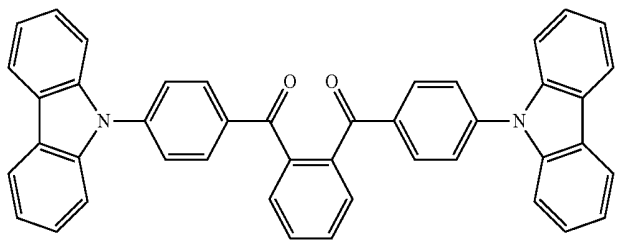

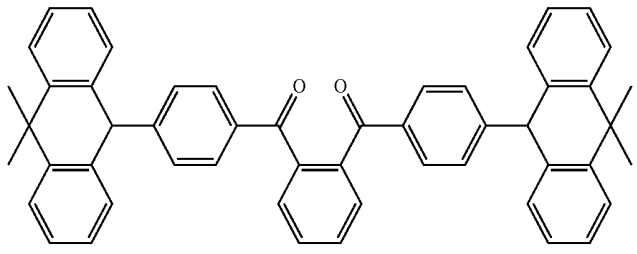

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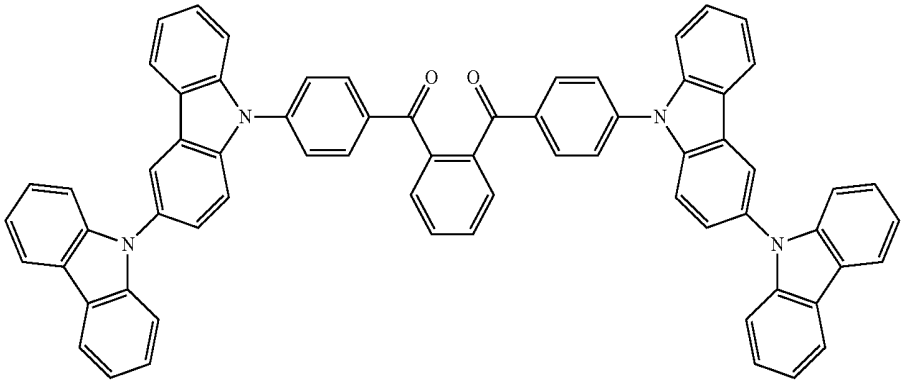

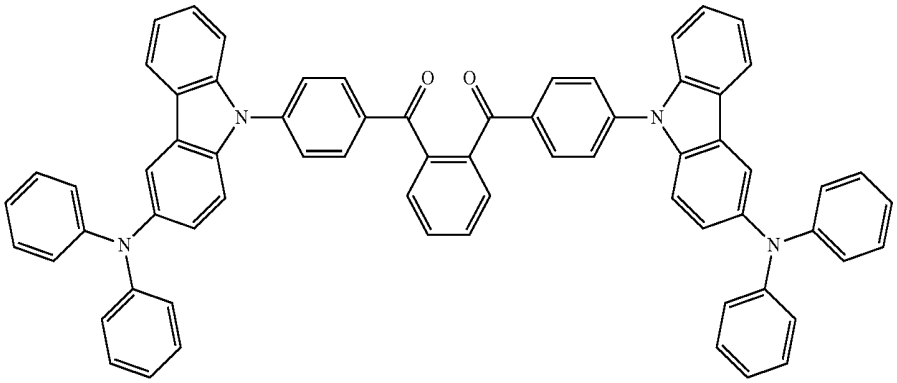

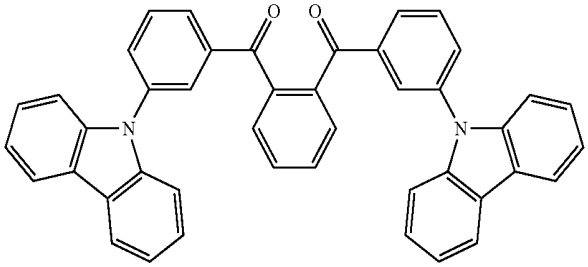

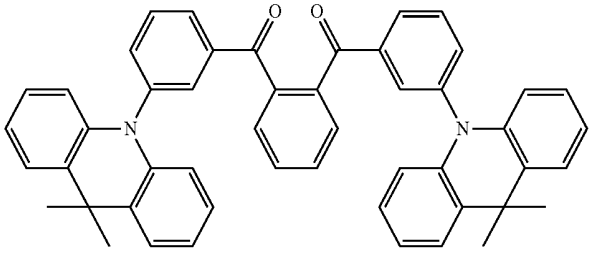

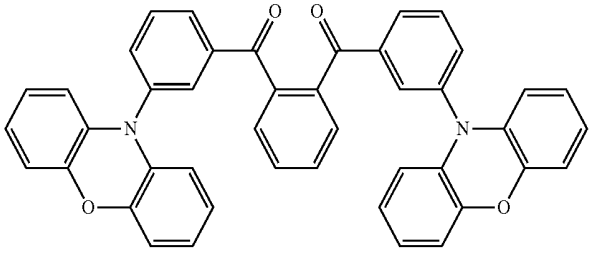

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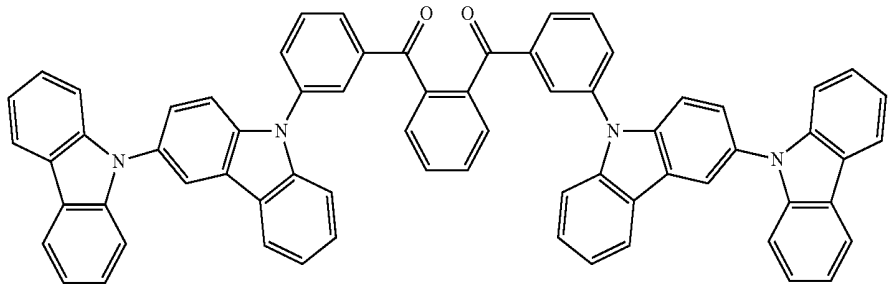

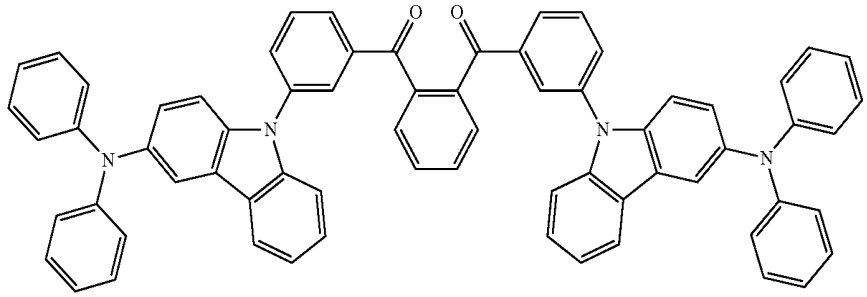

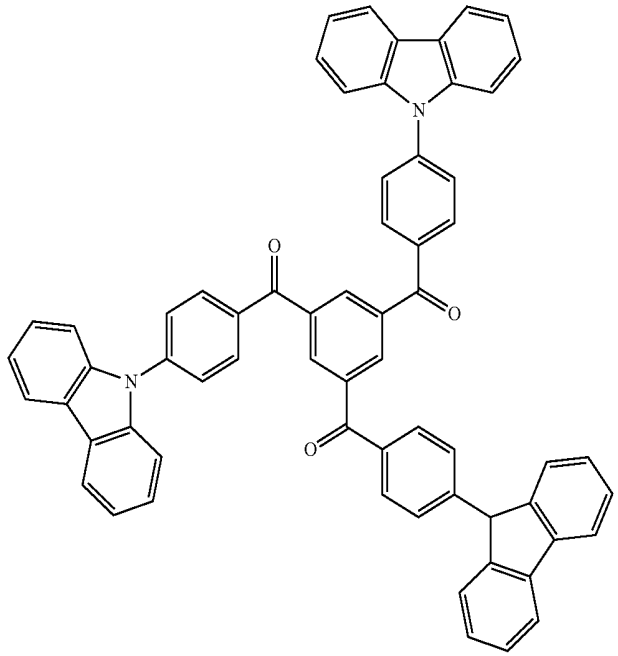

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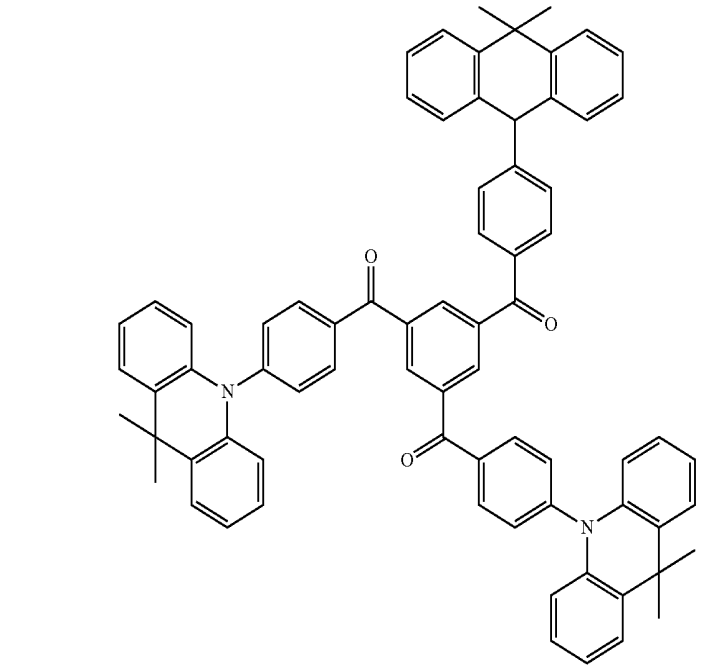

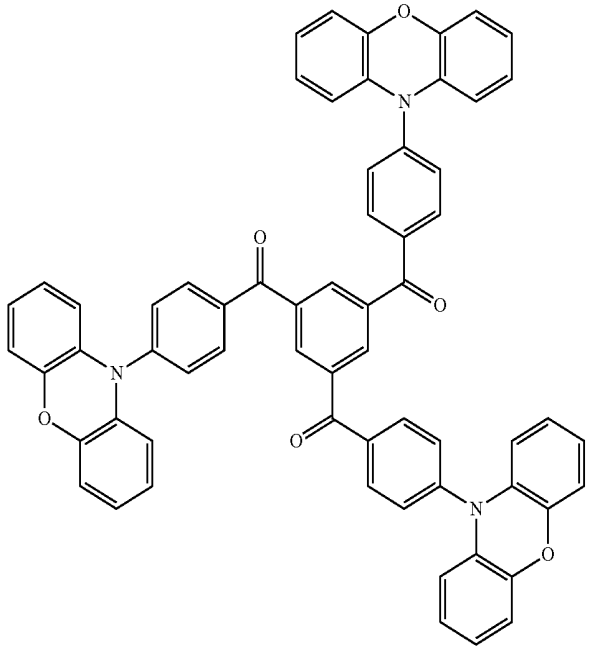

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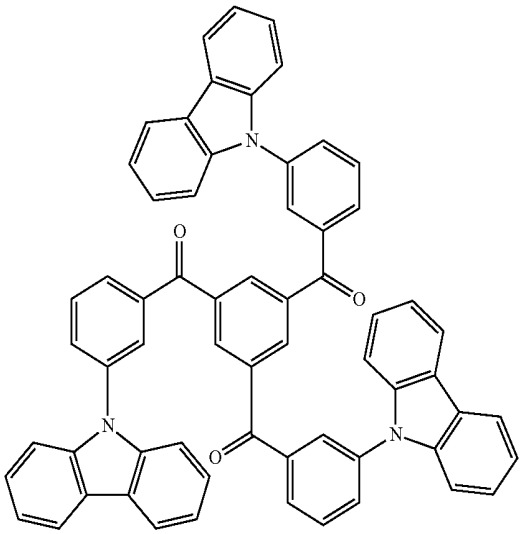

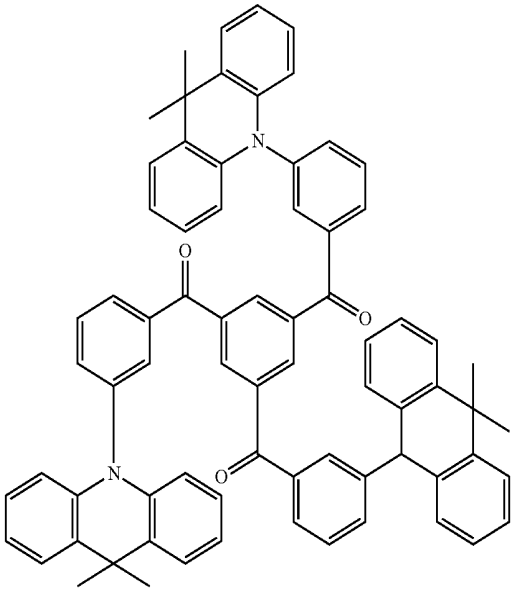

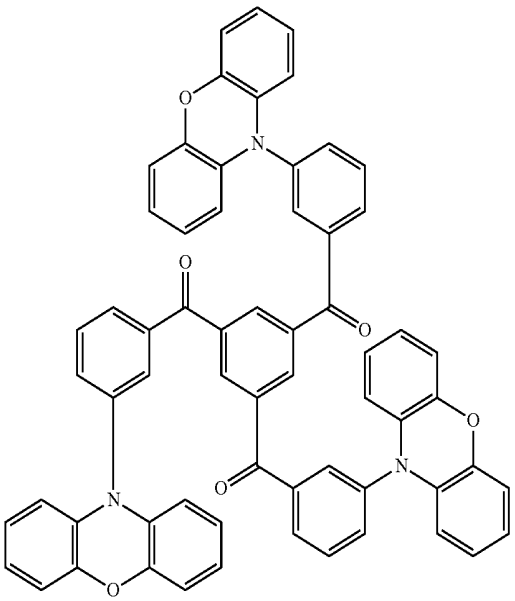

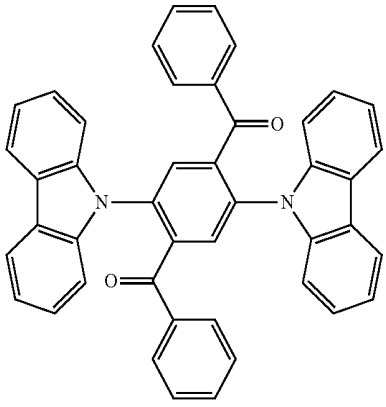

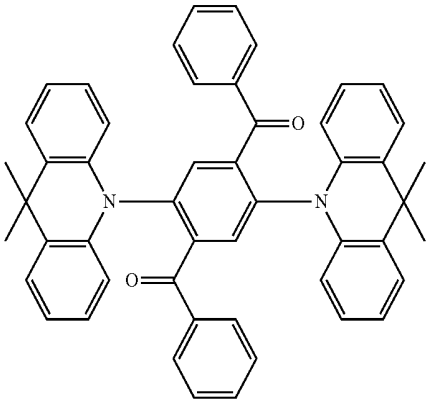

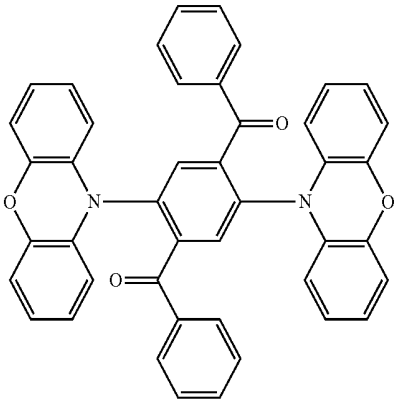

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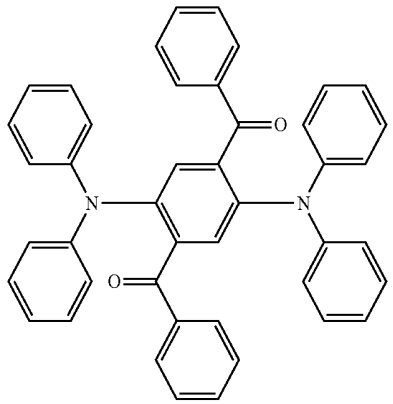

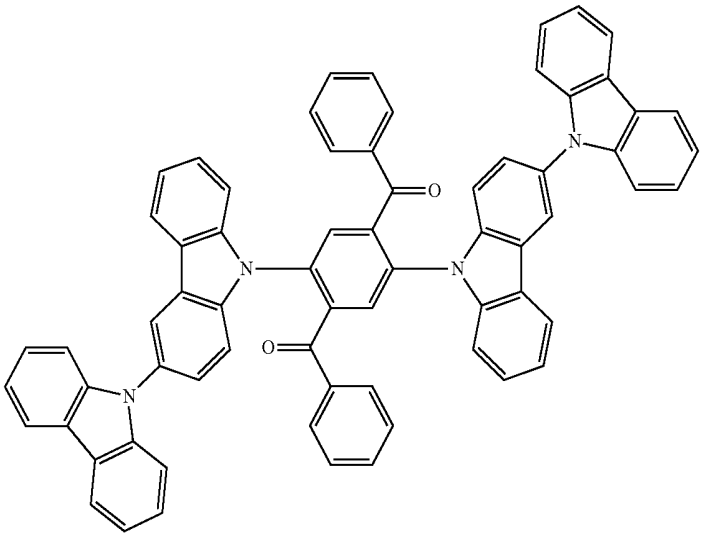

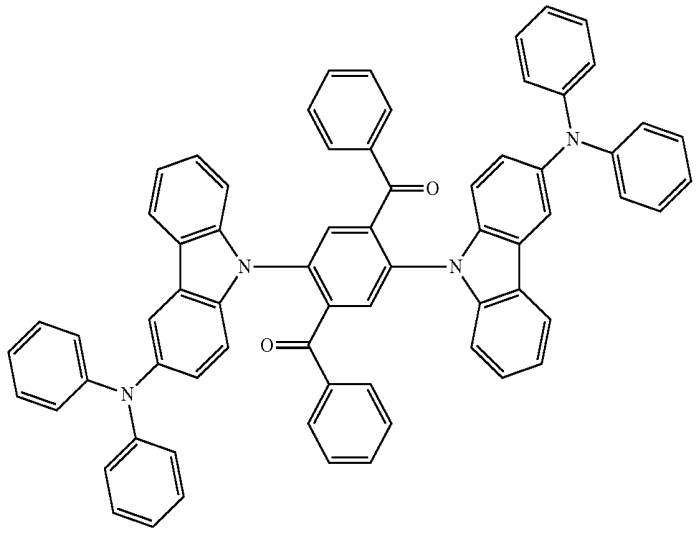

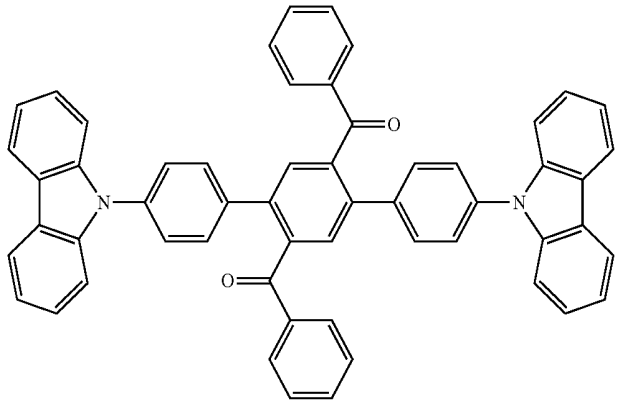

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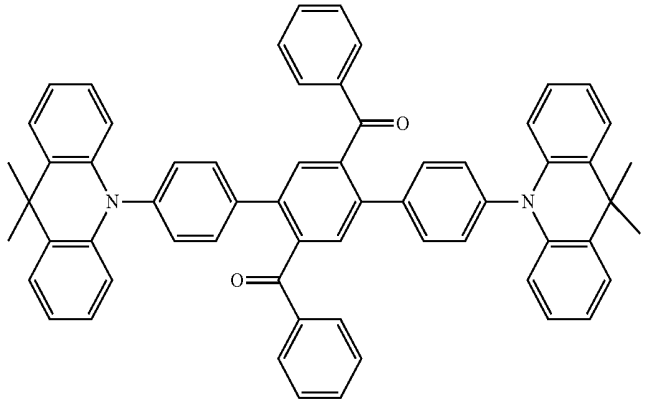
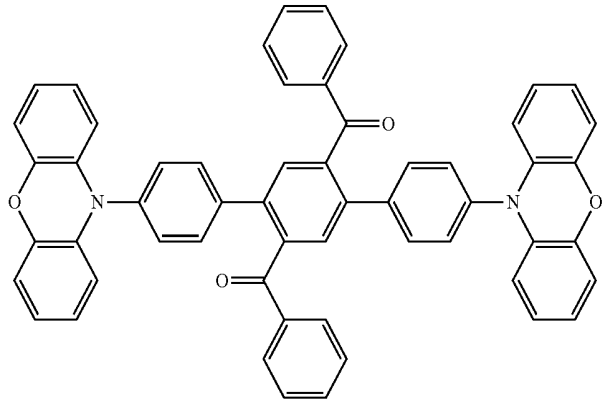
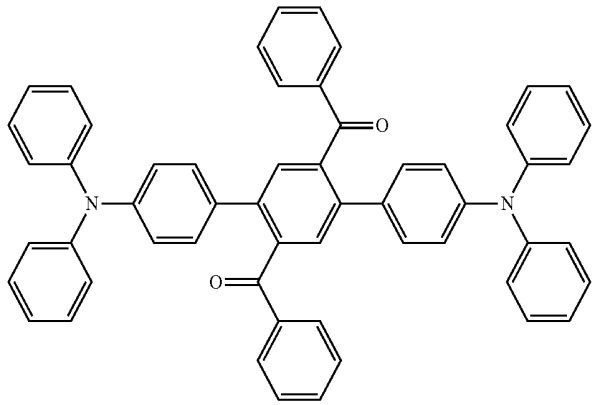


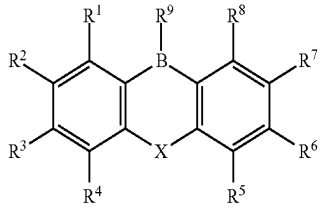




[0184] Examples of the preferred light-emitting material include the following compounds.

[0185] (1) A compound represented by the following general formula (281):

General Formula (281)



wherein in the general formula (281), X represents an oxygen atom or a sulfur atom; R^1 to R^8 each independently represent a hydrogen atom or a substituent, provided that at least one of R^1 to R^8 represents a group represented by any one of the following general formulae (282) to (287), and R^1 and R^2, R^2 and R^3, R^3 and R^4, R^5 and R^6, R^6 and R^7, R^7 and R^8, R^8 and R^9, and R^9 and R^1 may be bonded to each other to form a cyclic structure; and R^9 represents a substituent, provided that when R^9 contains an atom that contains a lone electron pair without forming a single bond to the boron atom, the atom may form a cyclic structure through a coordination bond with the boron atom:

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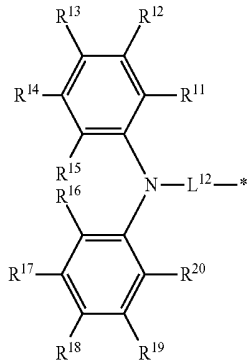
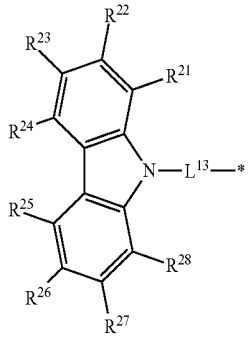
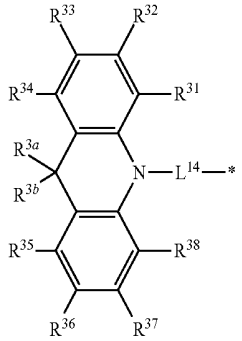
General Formula (282)



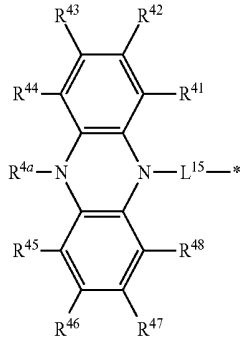
General Formula (283)



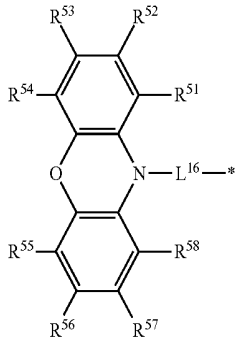
General Formula (284)



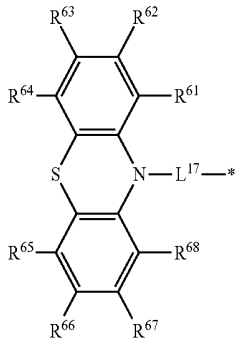
General Formula (285)



General Formula (286)



General Formula (287)



wherein in the general formulae (282) to (287), L^{12} to L^{17} each independently represent a single bond or a divalent linking group; * represents the position bonded to the benzene ring in the general formula (281); and R^{11} to R^{20}, R^{21} to R^{28}, R^{31} to R^{38}, R^{3a}, R^{3b}, R^{41} to R^{48}, R^{4a}, R^{51} to R^{58}, R^{61} to R^{68} each independently represent a hydrogen atom or a substituent, in which R^{11} and R^{12}, R^{12} and R^{13}, R^{13} and R^{14}, R^{14} and R^{15}, R^{16} and R^{17}, R^{17} and R^{18}, R^{18} and R^{19}, R^{19} and R^{20}, R^{21} and R^{22}, R^{22} and R^{23}, R^{23} and R^{24}, R^{24} and R^{25}, R^{25} and R^{26}, R^{26} and R^{27}, R^{27} and R^{28}, R^{31} and R^{32}, R^{32} and R^{33}, R^{33} and R^{34}, R^{35} and R^{36}, R^{36} and R^{37}, R^{37} and R^{38}, R^{3a} and R^{3b}, R^{41} and R^{42}, R^{42} and R^{43}, R^{4a} and R^{4b}, R^{45} and R^{46}, R^{46} and R^{47}, R^{47} and R^{48}, R^{51} and R^{52}, R^{52} and R^{53}, R^{53} and R^{54}, R^{55} and R^{56}, R^{56} and R^{57}, R^{57} and R^{58}, R^{61} and R^{62}, R^{62} and R^{63}, R^{63} and R^{64}, R^{65} and R^{66}, R^{66} and R^{67}, and R^{67} and R^{68} each may be bonded to each other to form a cyclic structure.

[0186] (2) The compound according to the item (1), wherein in the general formula (281), at least one of R^1 to R^8 represents a group represented by any one of the general formulae (283) to (287),

[0187] (3) The compound according to the item (1) or (2), wherein In the case where at least one of R^1 to R^8 in the general formula (281) represents a group represented by the general formula (283), at least one of R^{21} to R^{28} in the general formula (283) represents a substituent.

[0188] (4) The compound according to any one of the items (1) to (3), wherein in the general formula (281), at

least one of R^2, R^3, R^6, and R^7 represents a group represented by any one of the general formulae (262) to (287).

[0189] (5) The compound according to the item (4), wherein in the general formula (281), at least one of R^3 and R^6 represents a group represented by any one of the general formulae (262) to (287).

[0190] (6) The compound according to the item (5), wherein in the general formula (281), R^3 and R^6 each independently represent a group represented by any one of the general formulae (282) to (287).

[0191] (7) The compound according to any one of the stems (1) to (6), wherein at least one of R^{11} to R^{20} in the general formula (282), at least one of R^{21} to R^{28} in the general formula (283), at least one of R^{31} to R^{38} and at least one of R^{3a} and R^{3b} in the general formula (284), at least one of R^{41} to R^{48} in the general formula (285), at least one of R^{51} to R^{58} in the general formula (286), and at least one of R^{61} to R^{68} in the general formula (287) each represent a substituent.

[0192] (8) The compound according to the item (7), wherein at least one of R^{13} and R^{18} in the general formula (282), at least one of R^{23} and R^{26} in the general formula (283), at least one of R^{33} and R^{36} and at least one of R^{3a} and R^{3b} in the general formula (284), at least one of R^{43} and R^{46} in the general formula (285), at least one of R^{53} and R^{56} in the general formula (286), and at lease one of R^{63} and R^{66} in the general formula (287) each represent a substituent.

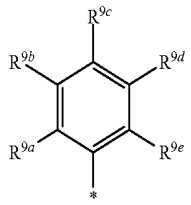
[0193] (9) The compound according to the item (8), wherein at least one of R^{13} and R^{18} in the general formula (262), at least one of R^{23} and R^{26} in the general formula (283), at least one of R^{33} and R^{36} and at least one of R^{3a} and R^{3b} in the general formula (264), at least one of R^{43} and R^{46} in the general formula (285), at least one of R^{53} and R^{56} in the general formula (286), and at least one of R^{63} and R^{66} in the general formula (287) each represent a group represented by any one of the general formulae (282) to (287).

[0194] (10) The compound according to any one of the items (1) to (5), wherein in the general formulae (282) to (287), L^{12} to L^{17} each represent a single bond.

[0195] (11) The compound according to any one of the items (1) to (10), wherein in the general formula (281), X represents an oxygen atom.

[0196] (12) The compound according to any one of the items (1) to (11), wherein in the general formula (281), R^9 represents a group represented by the following general formula (a):

General Formula (a)



wherein in the general formula (a), * represents the position bonded to the boron atom in the general formula (281); and R^{9a}, R^{9b}, R^{9c}, R^{9d}, and R^{9e} each independently represent a hydrogen atom or a substituent, in which R^{9a} and R^{9b}, R^{9b} and R^{9c}, and R^{9d}, and R^{9d} and R^{9e} may be bonded to each other to form a cyclic structure.

[0197] (13) The compound according to the item (12), wherein in the general formula (a), R^{9a} and R^{9b} each represent a substituent.

[0198] (14) The compound according to any one of the items (1) to (13), wherein in the general formula (281), at least one of R^1 to R^8 represents a group represented by the general formula (284).

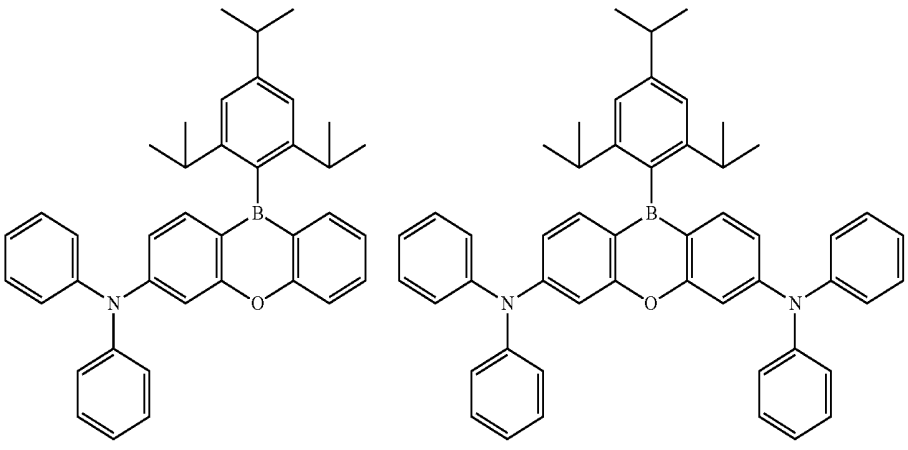
[0199] (15) The compound according to any one of the items (1) to (4), and (7) to (14), wherein in the general formula (281), R^3 and R^6, or R^2 and R^8 each represent a group represented by the general formula (284).

[0200] (16) The compound according to the item (14) or (15), wherein in the general formula (234), R^{3a} and R^{3b} each represent a substituent.

[0201] (17) The compound according to any one of the items (14) to (16), wherein the substituent is an alkyl group having from 1 to 15 carbon atoms or a phenyl group.

[0202] (18) The compound according to any one of the items (14) to (16), wherein in the general formula (284), R^{3a} and R^{3b} are bonded to each other to form a cyclic structure.

[0203] Examples of the compound include the following compounds.



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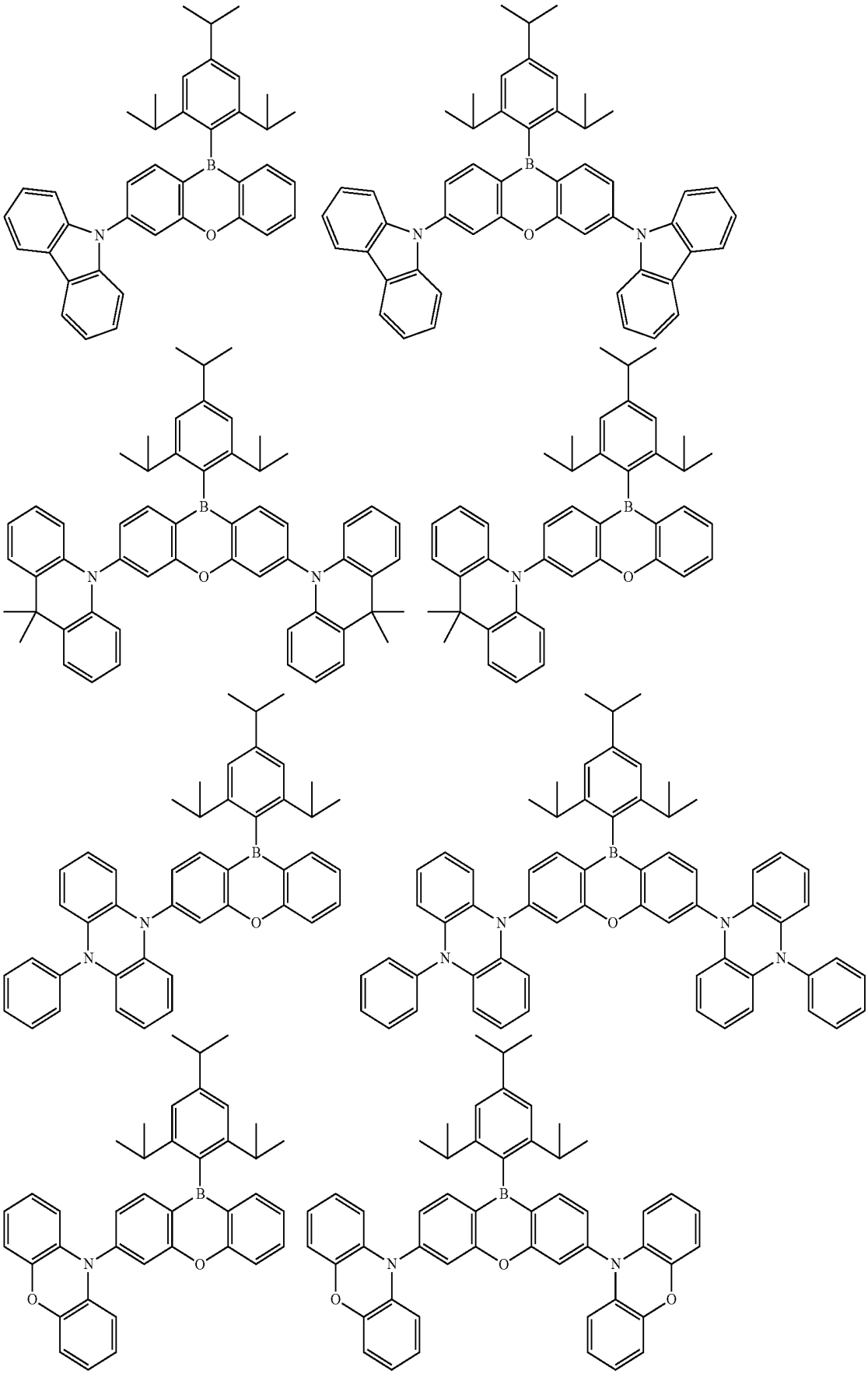

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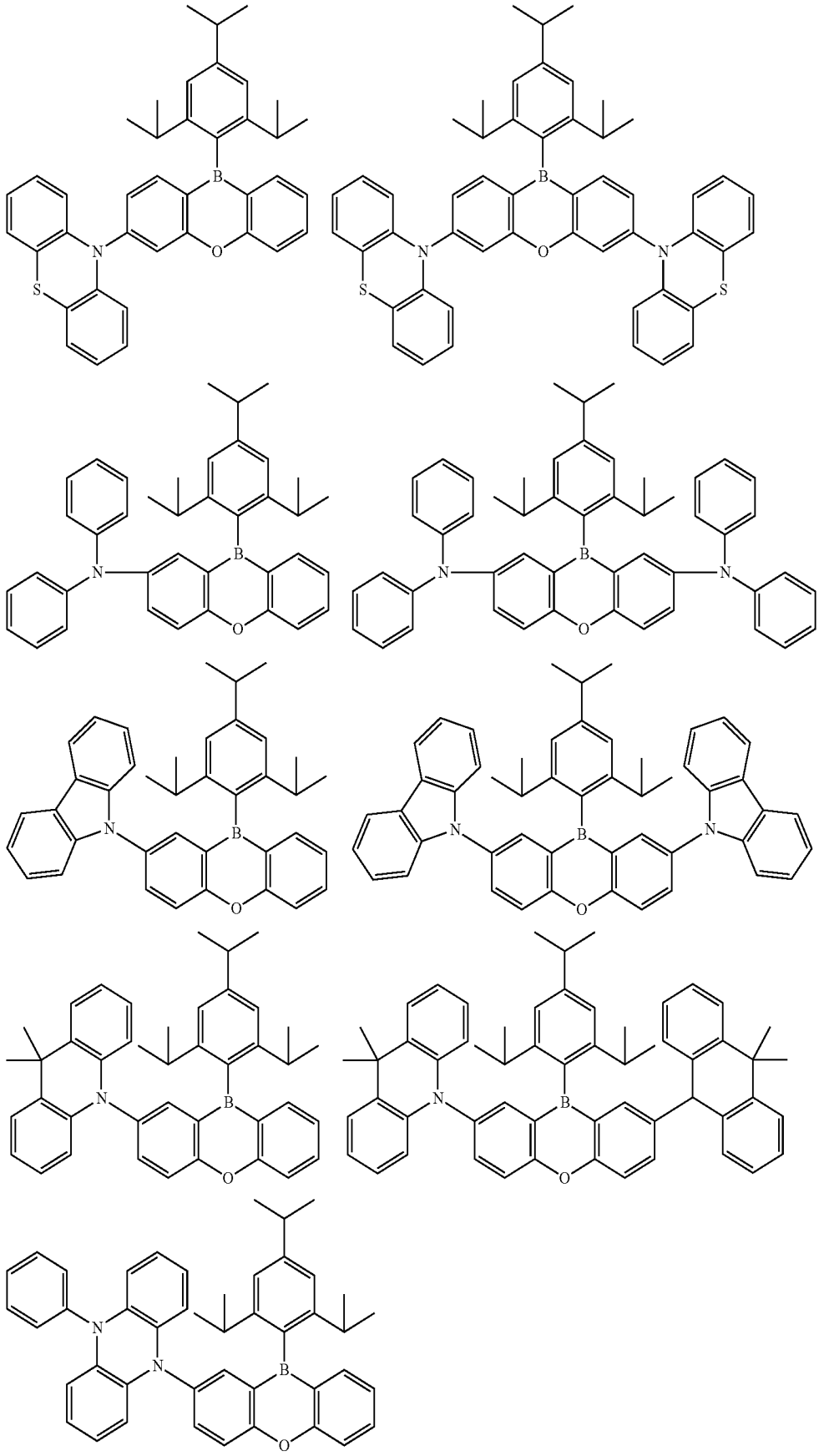

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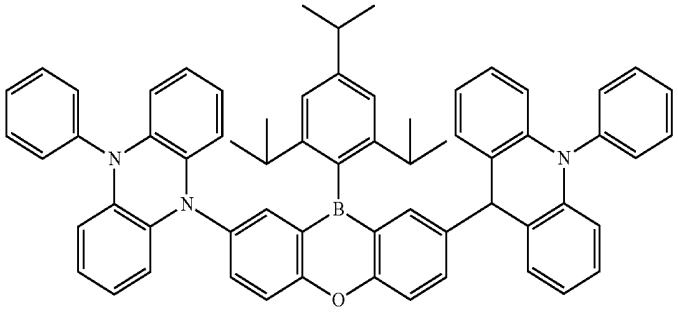

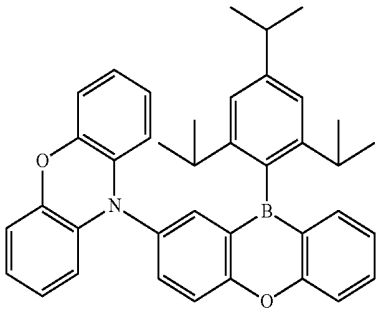

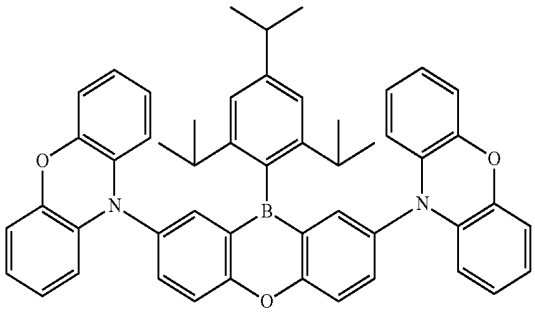

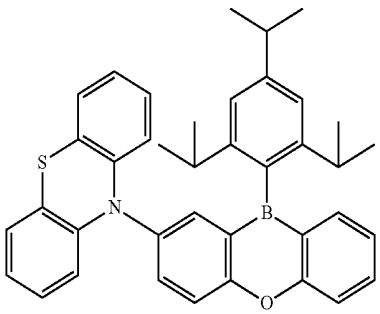

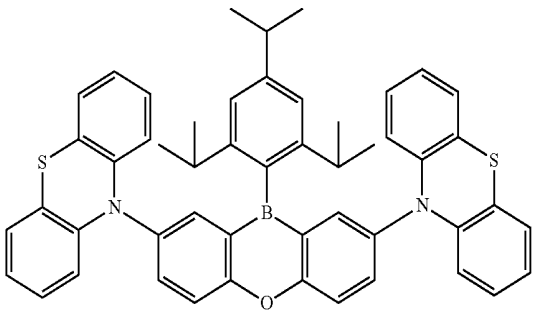

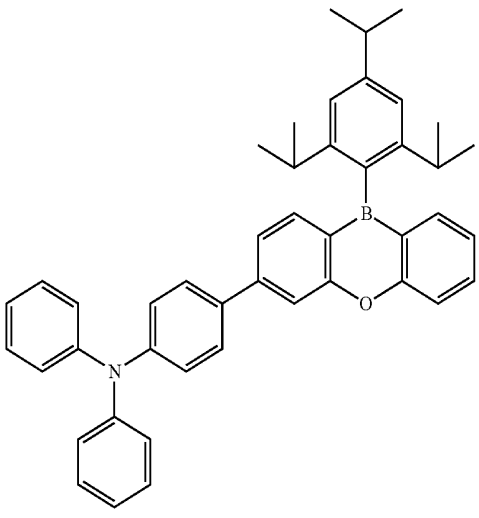

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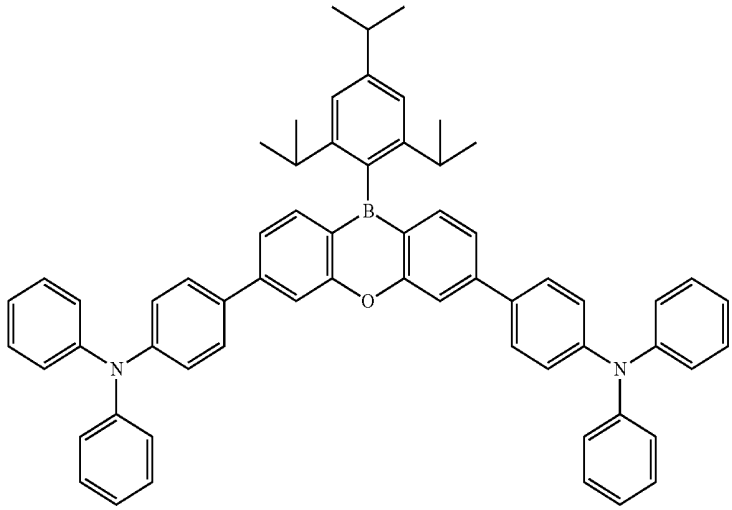

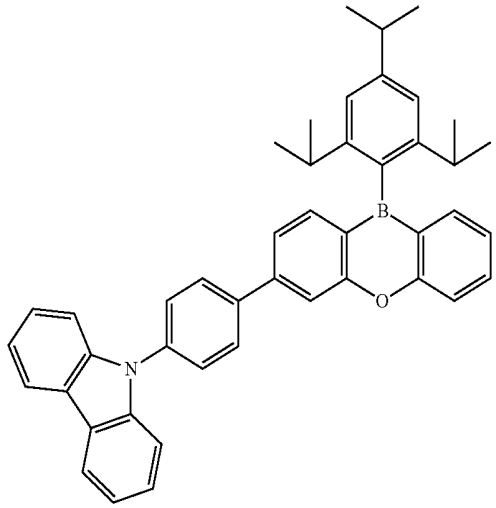

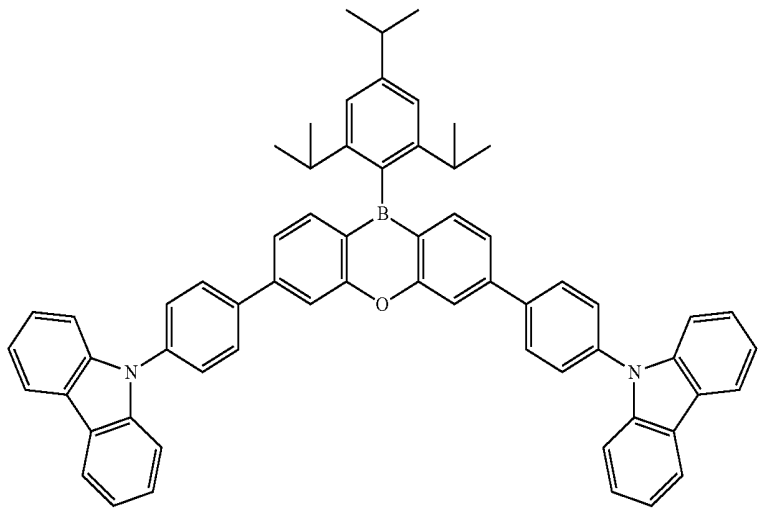

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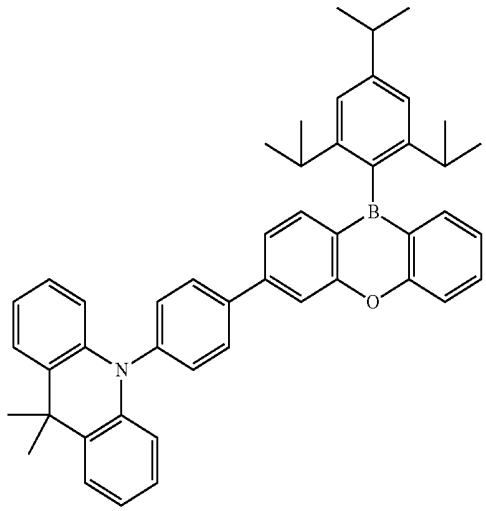

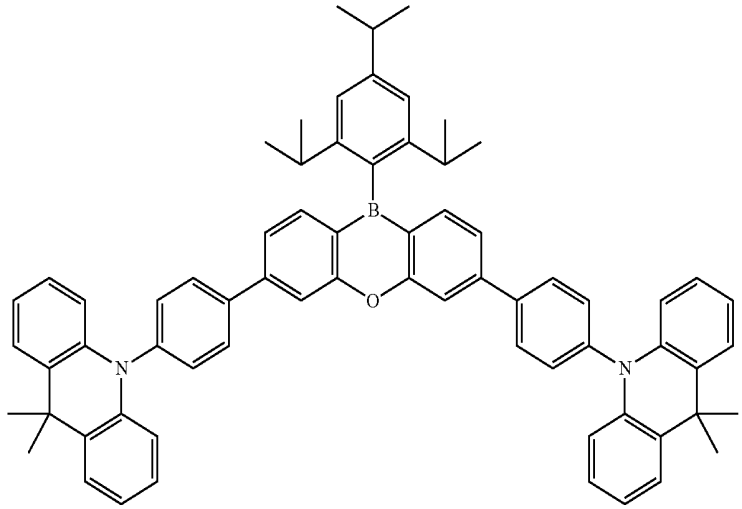

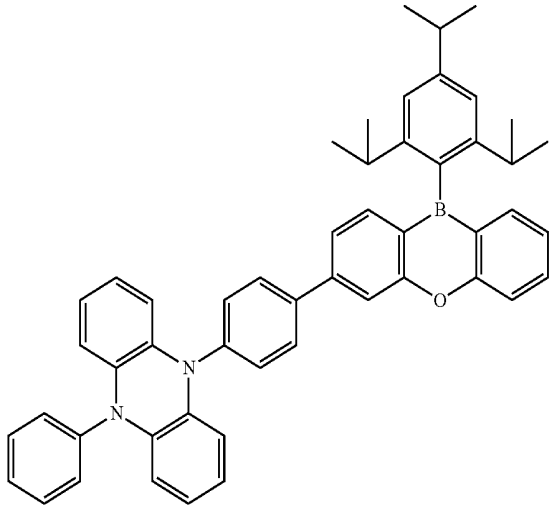

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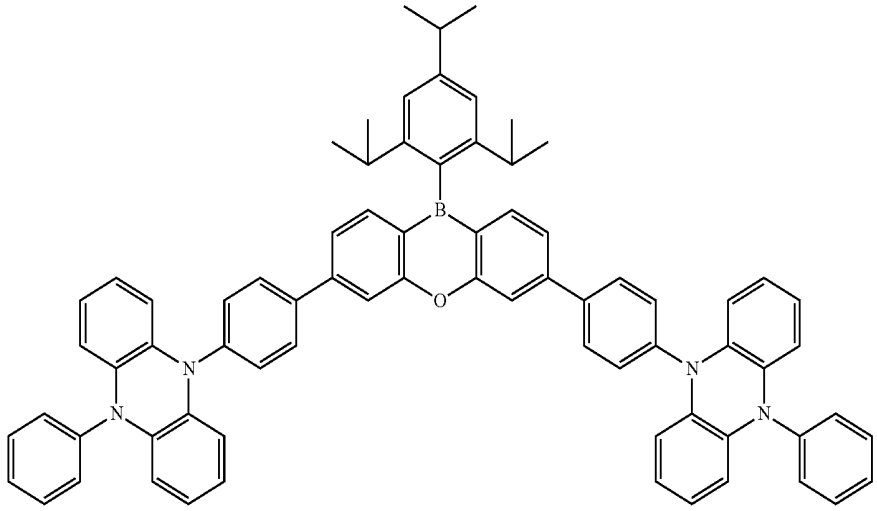

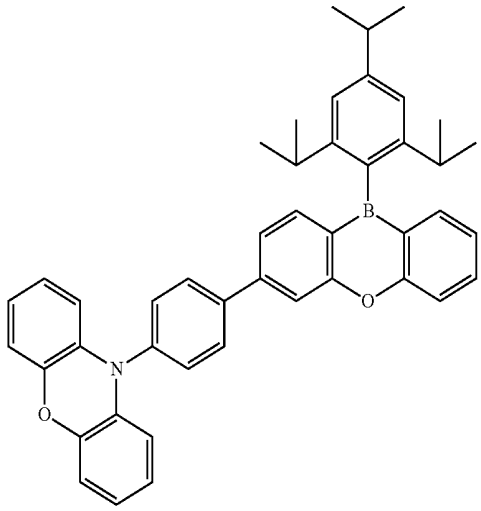

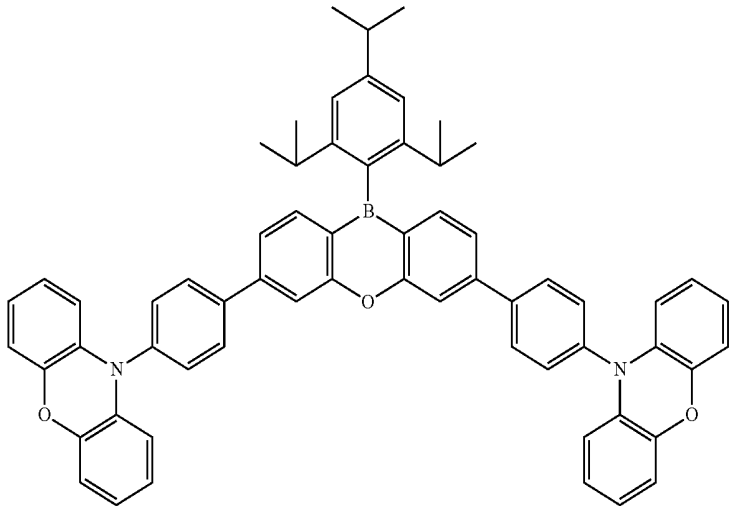

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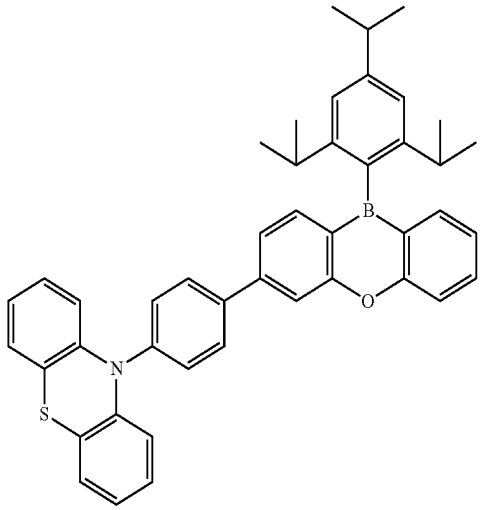

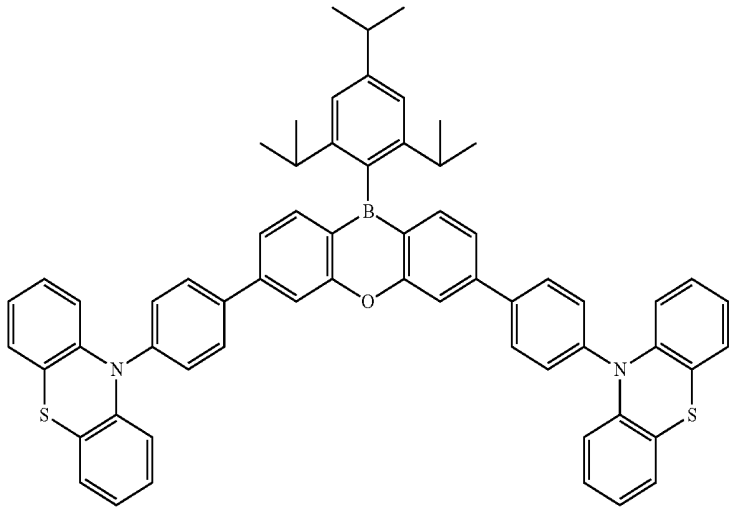

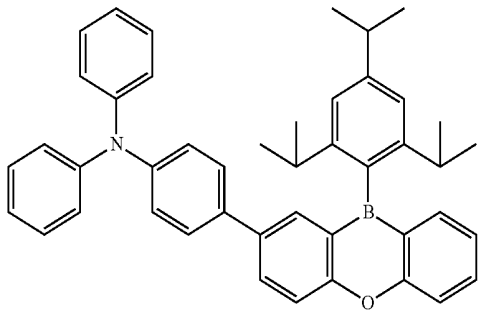

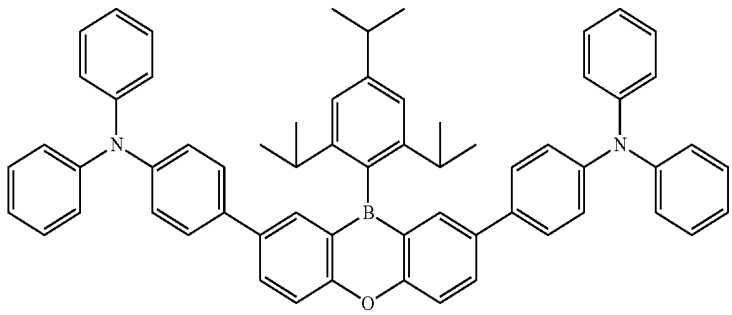

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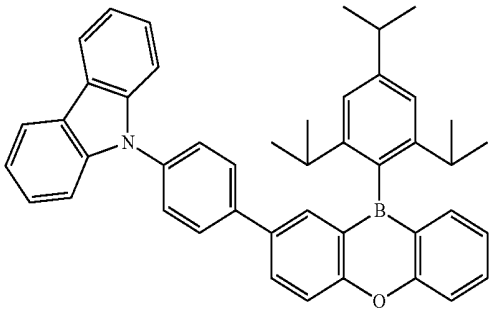

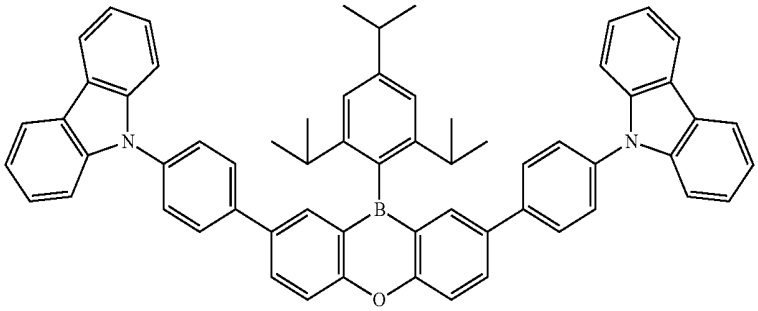

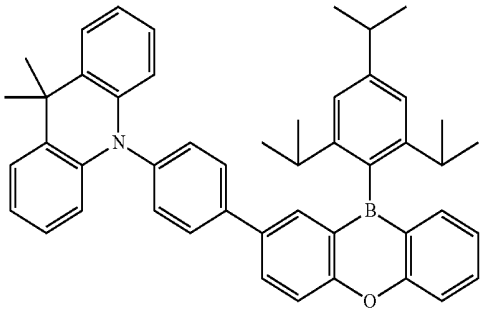

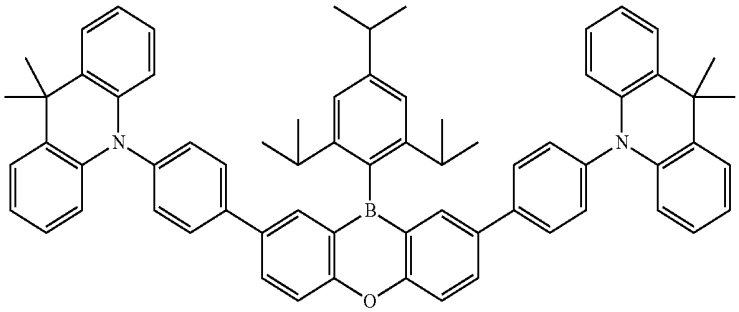

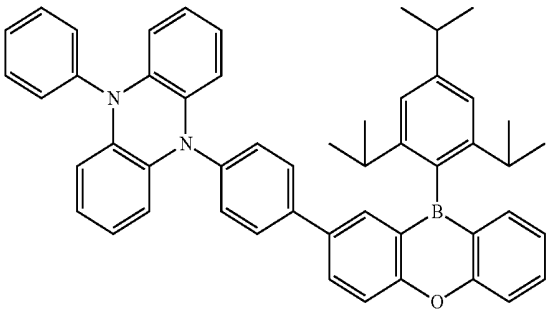

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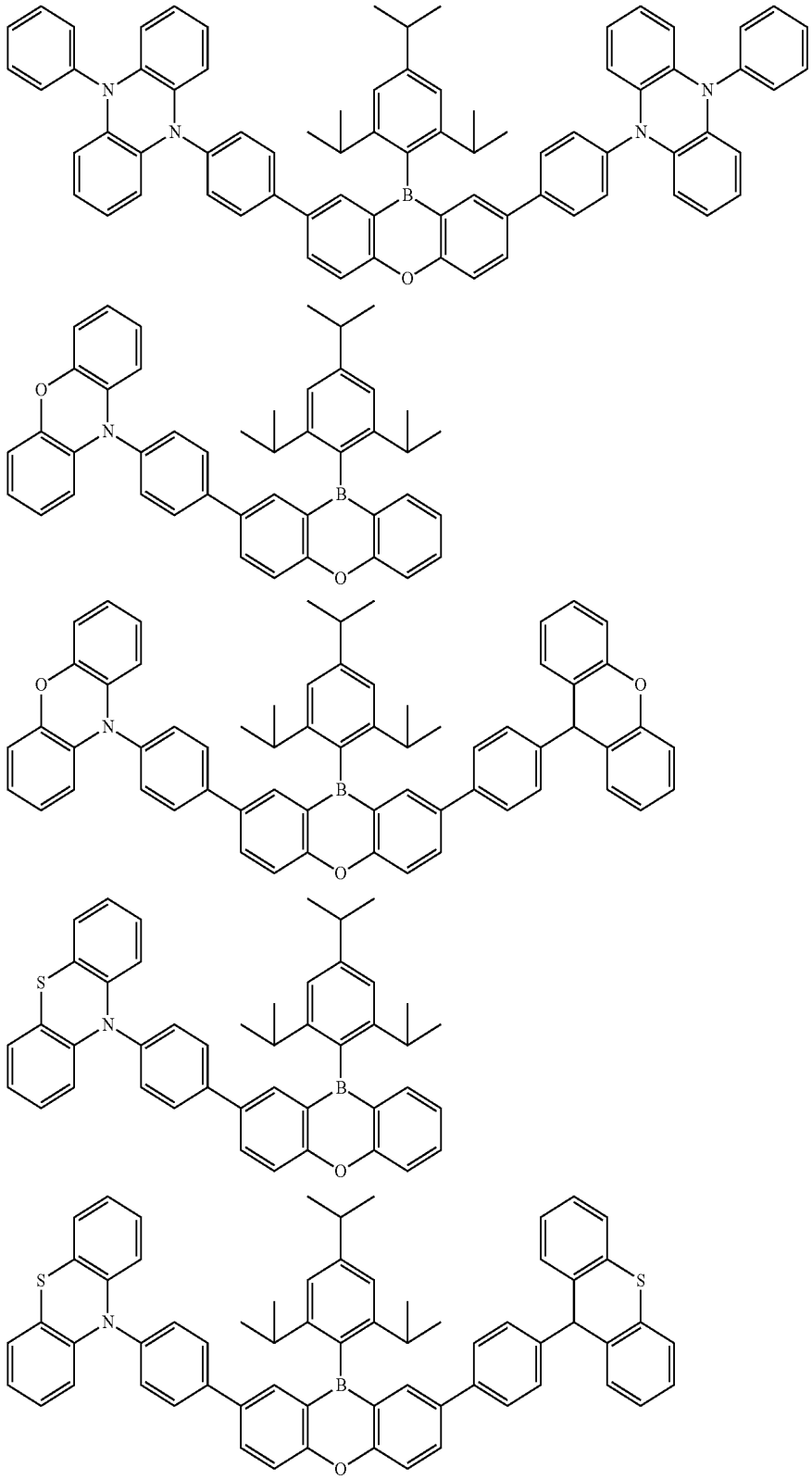

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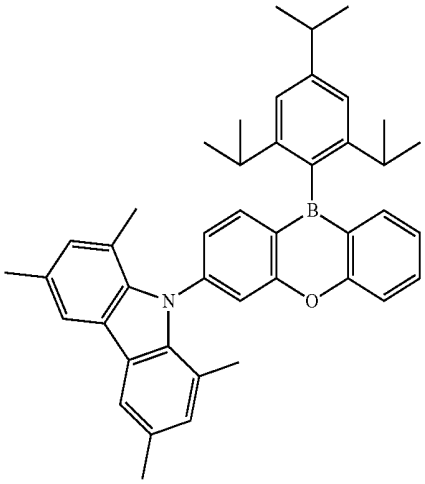

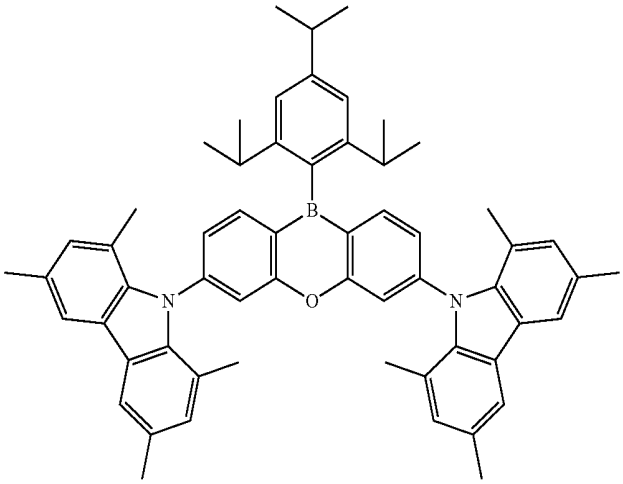

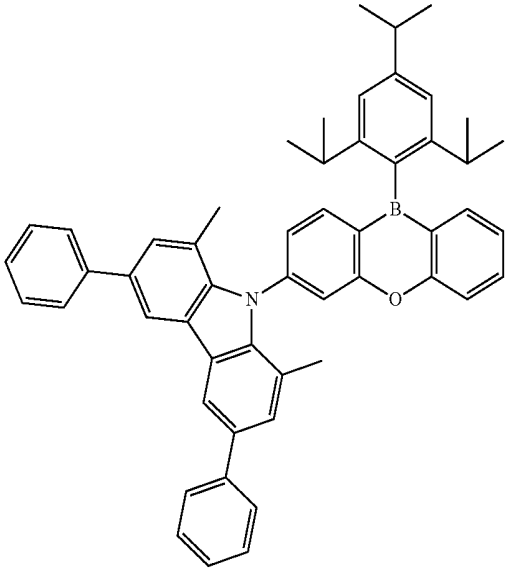

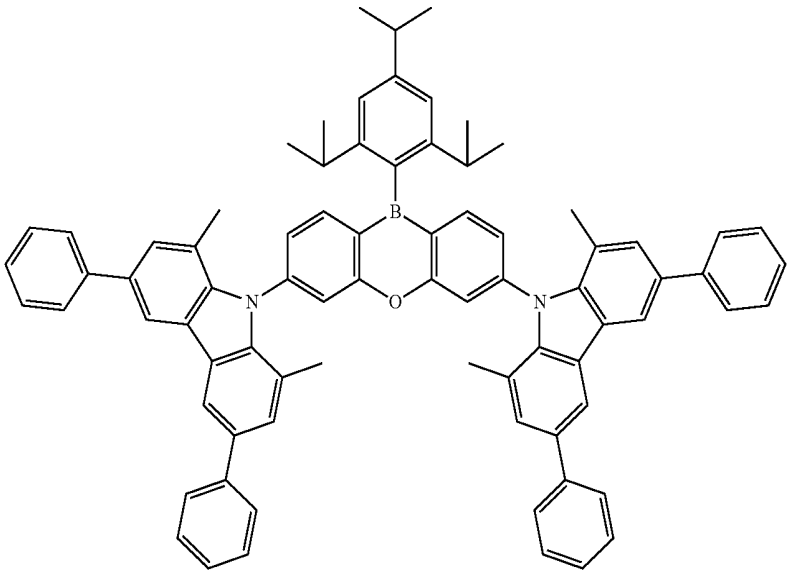

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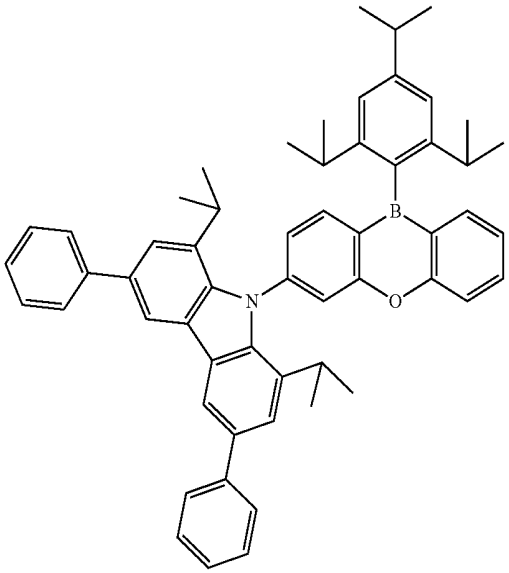

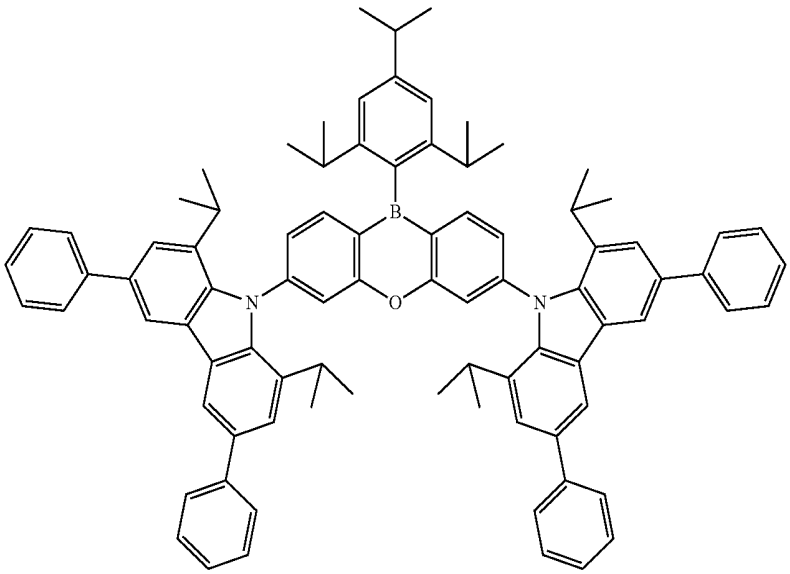

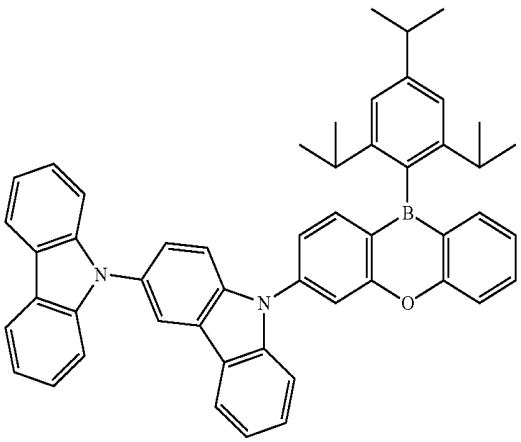

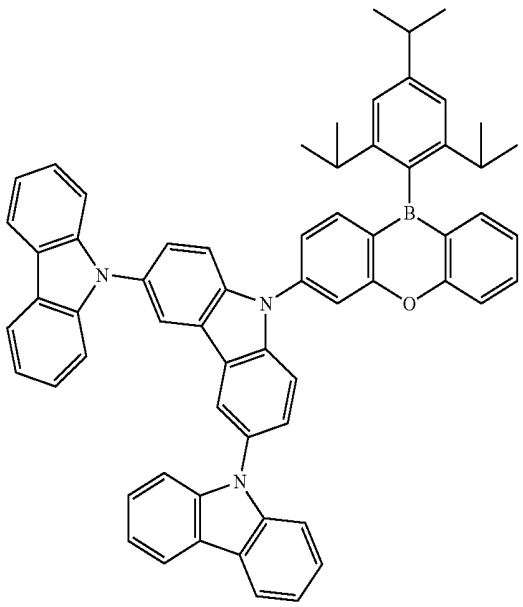

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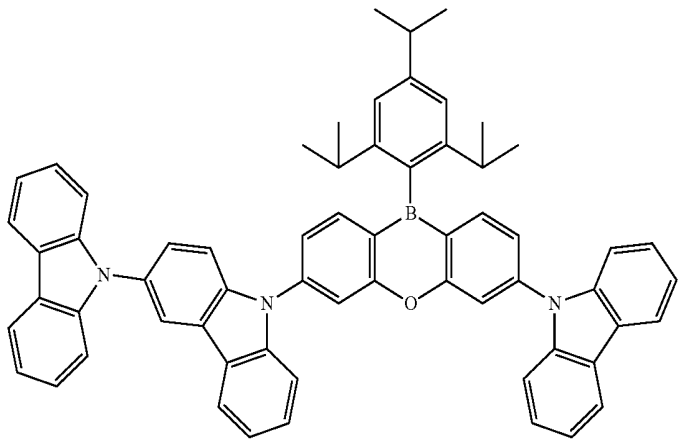

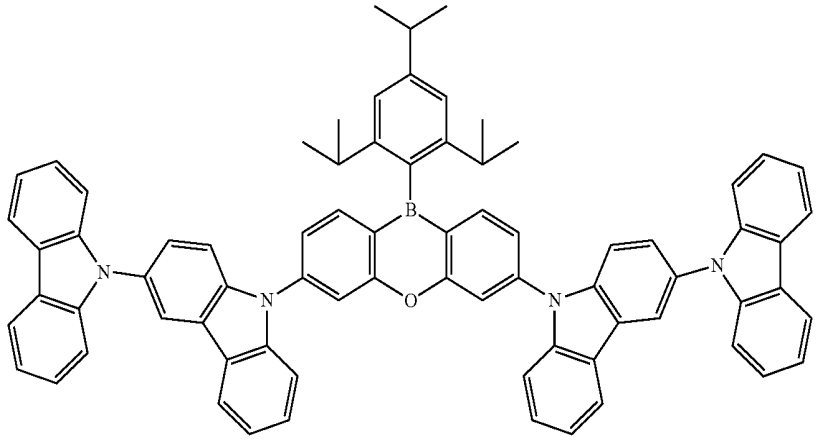

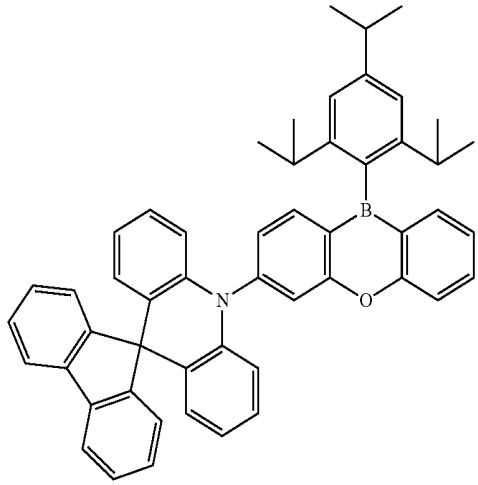

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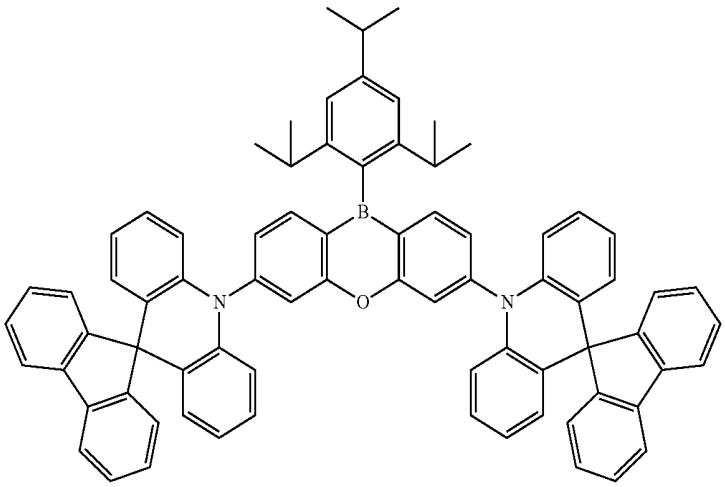

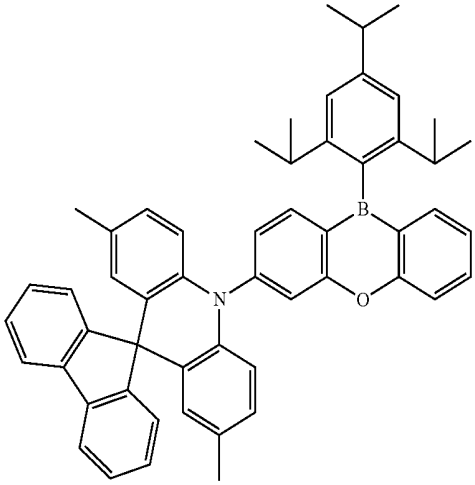

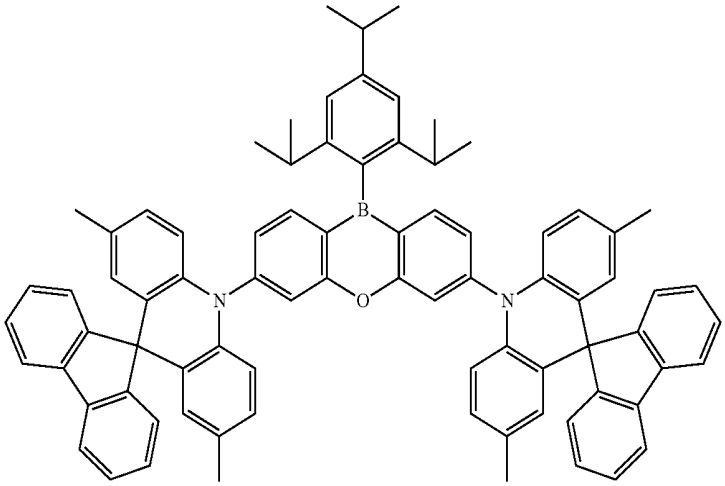

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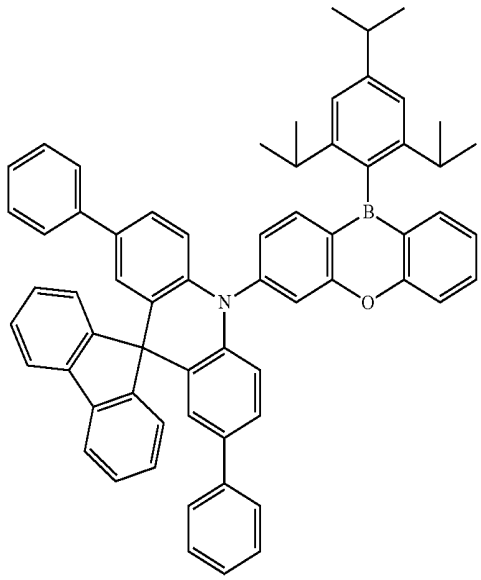

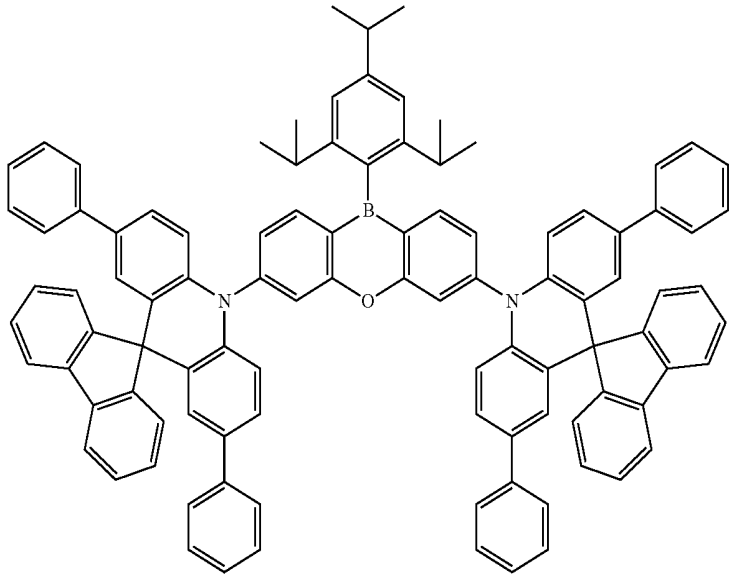

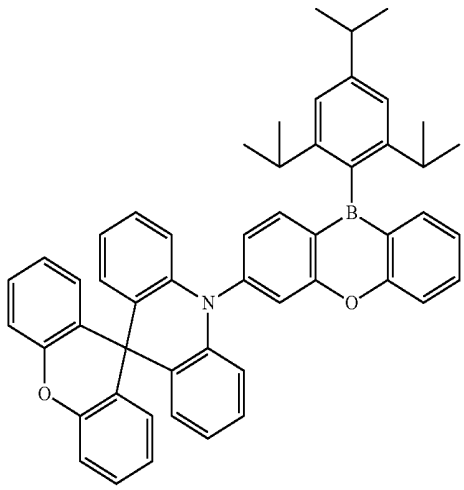

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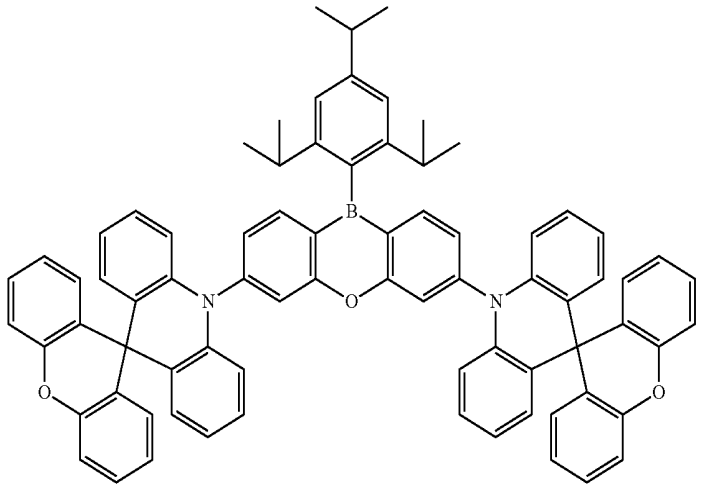

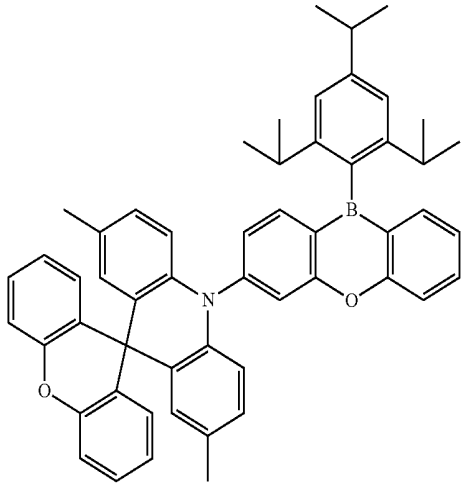

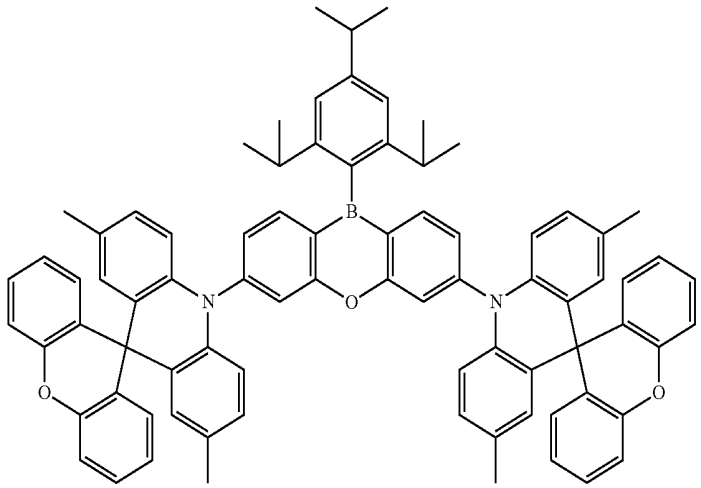

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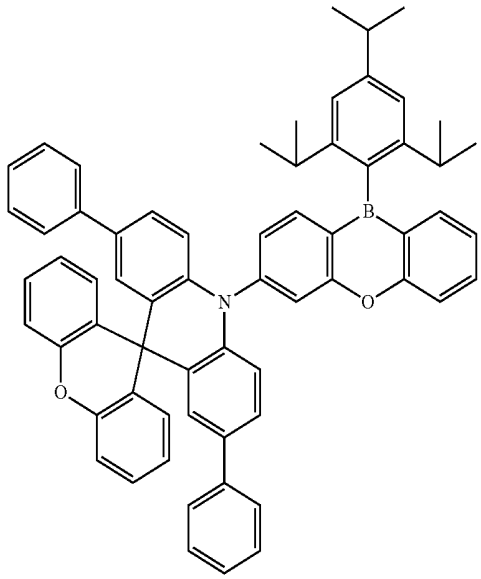

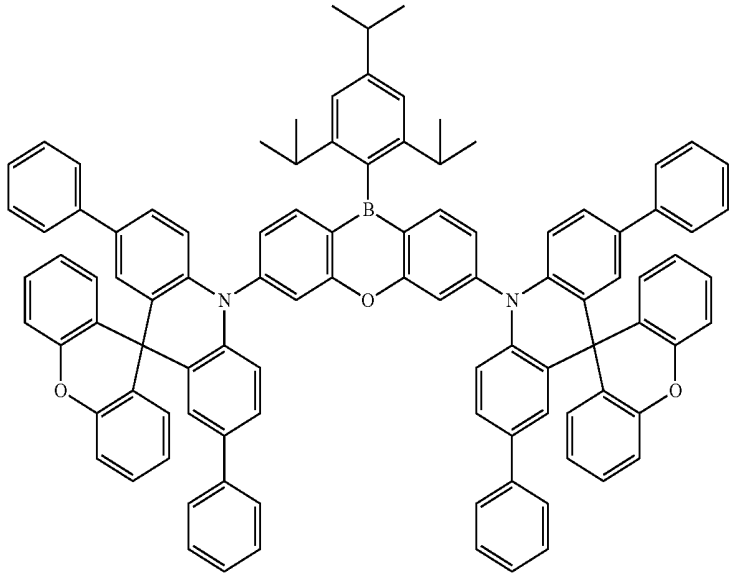

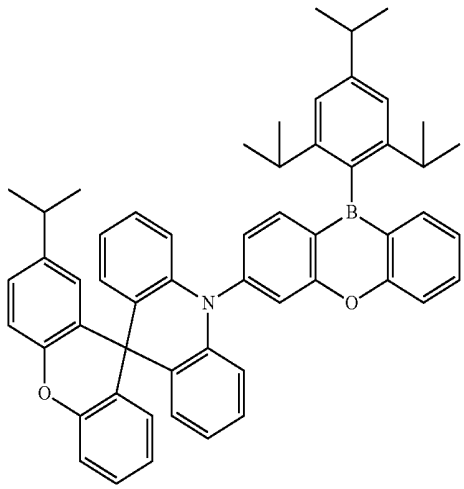

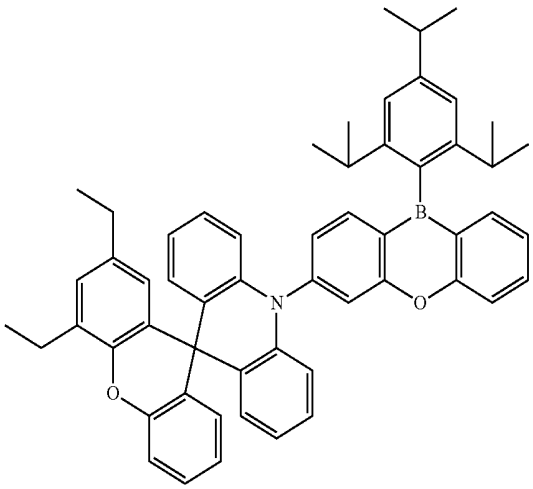

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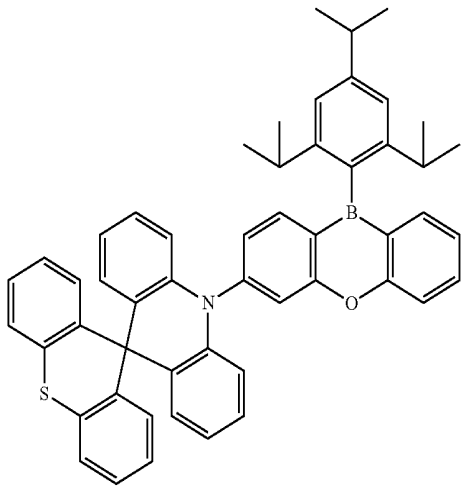

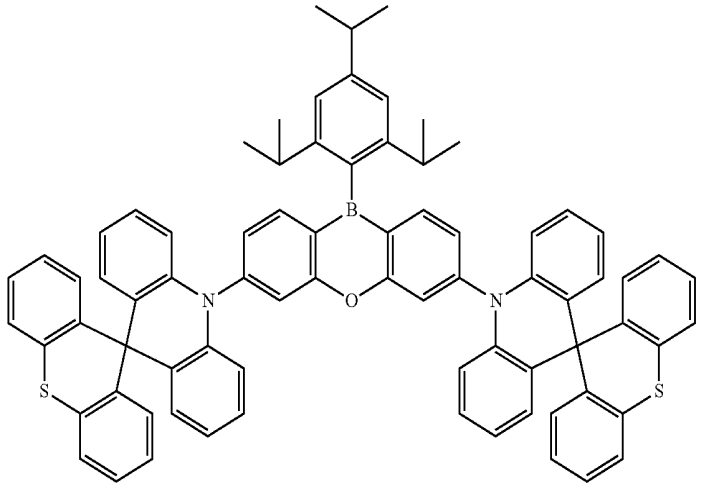

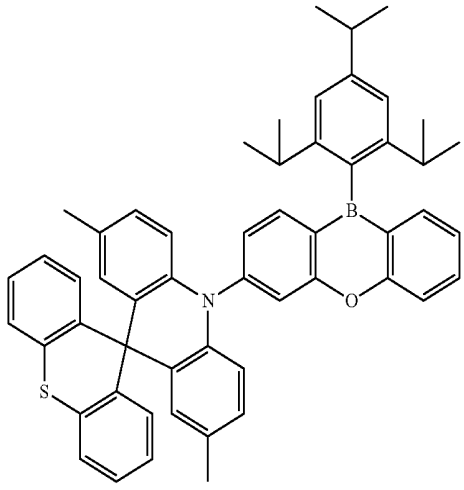

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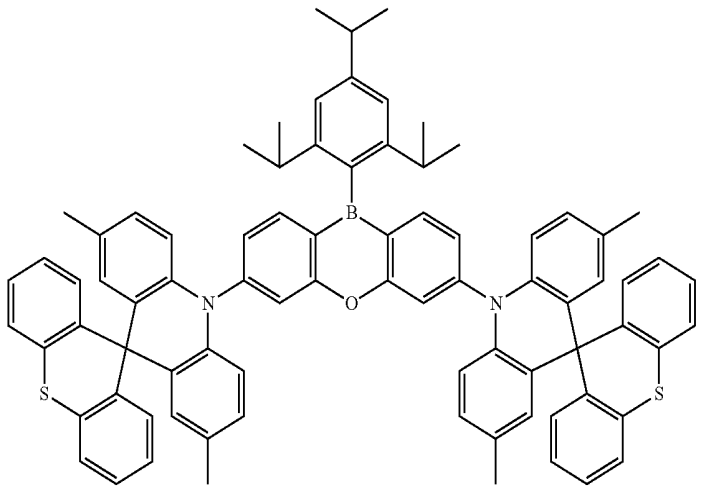

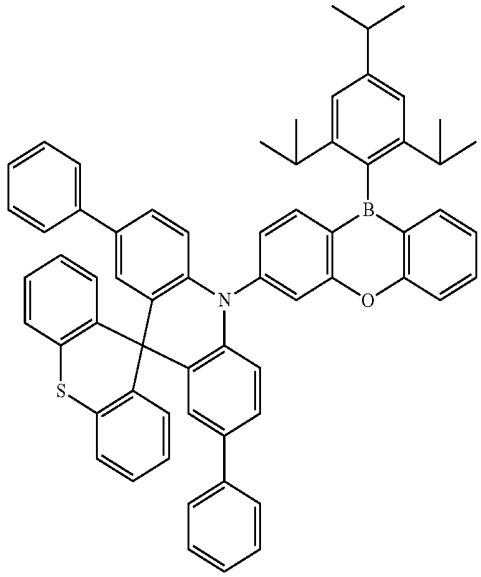

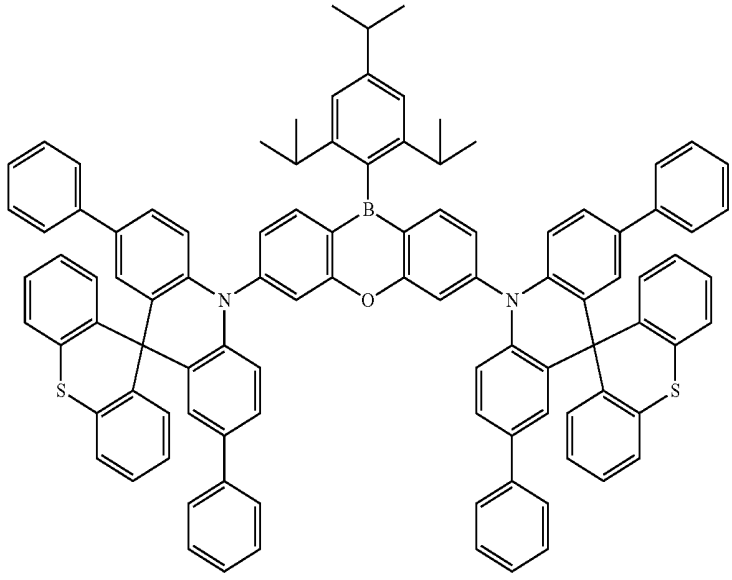

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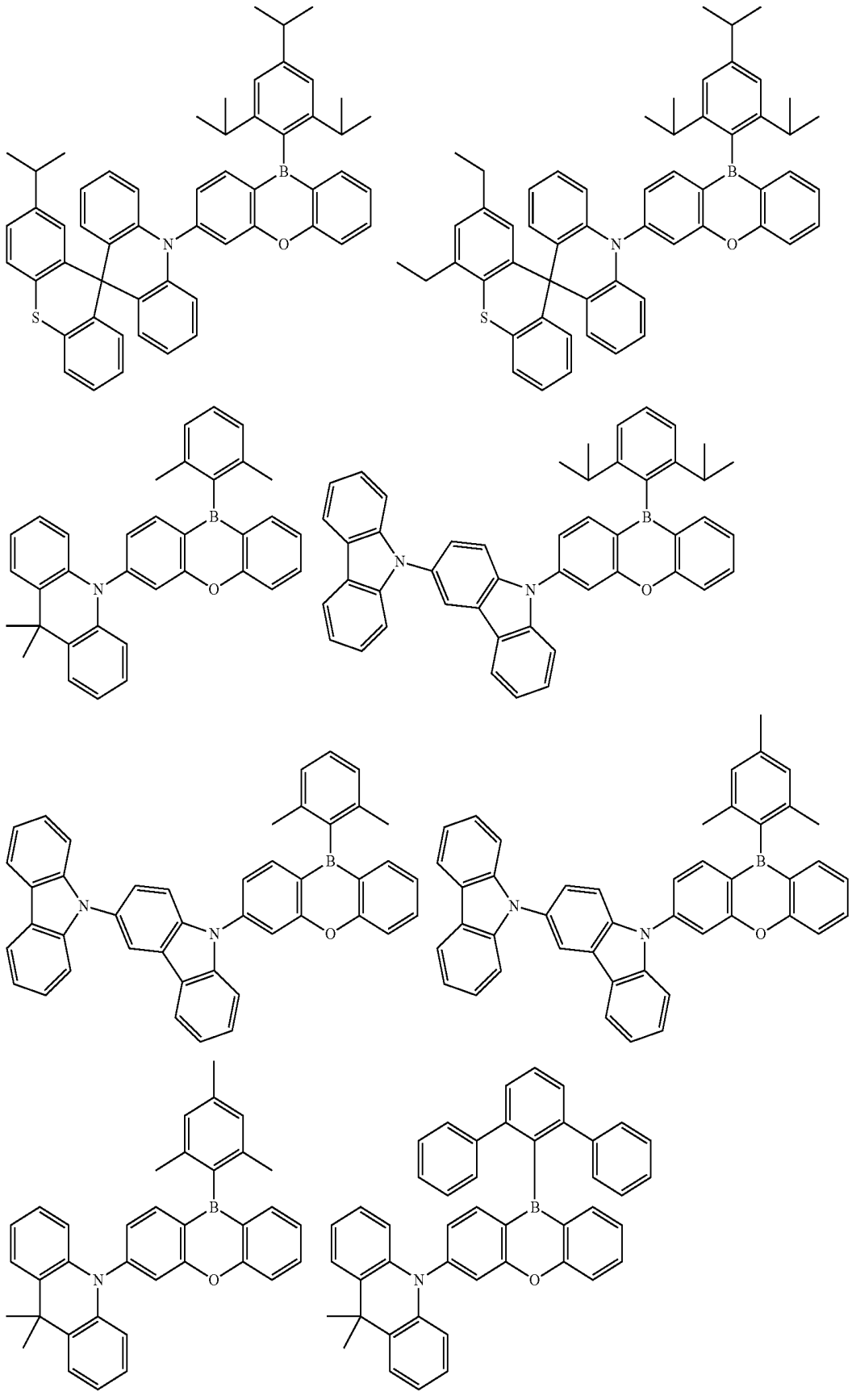

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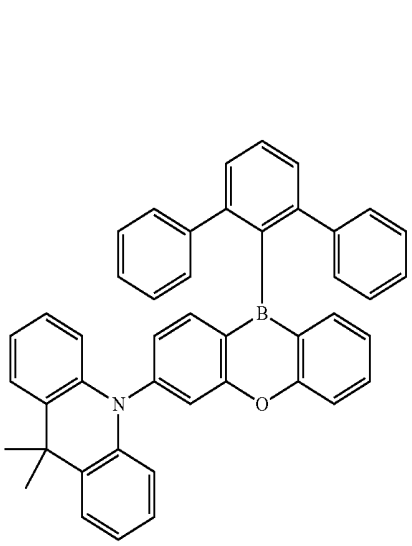
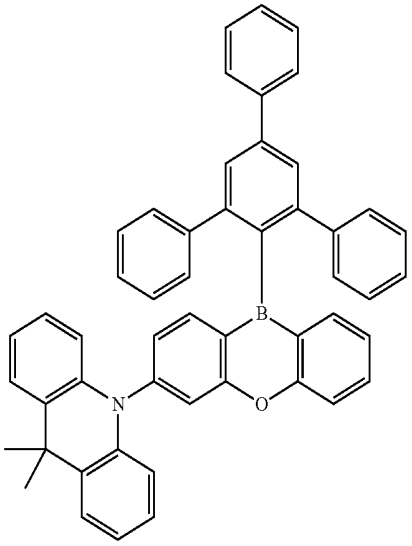
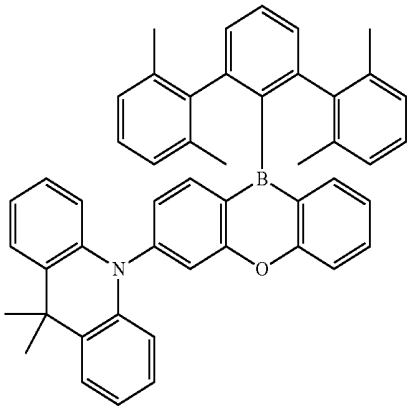
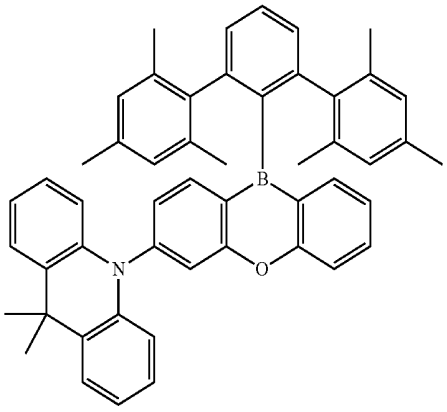
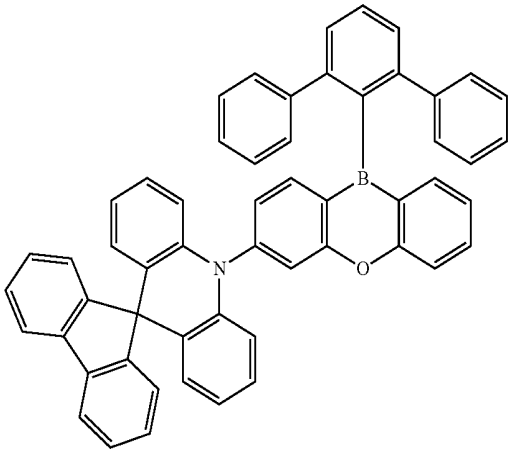
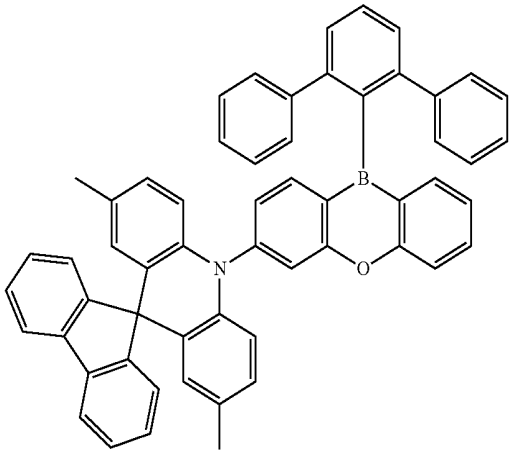

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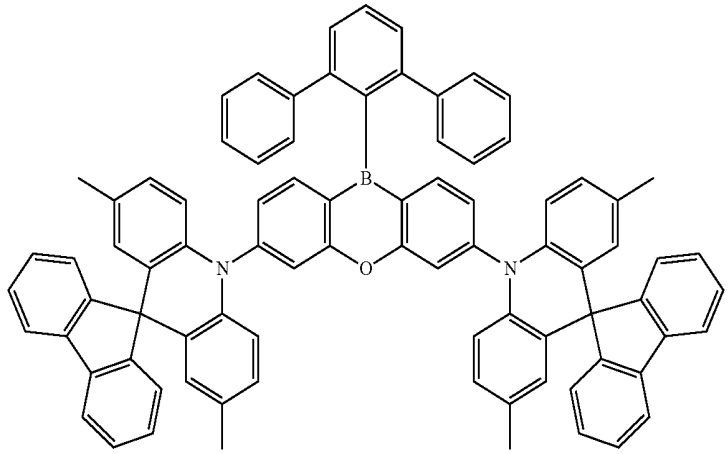

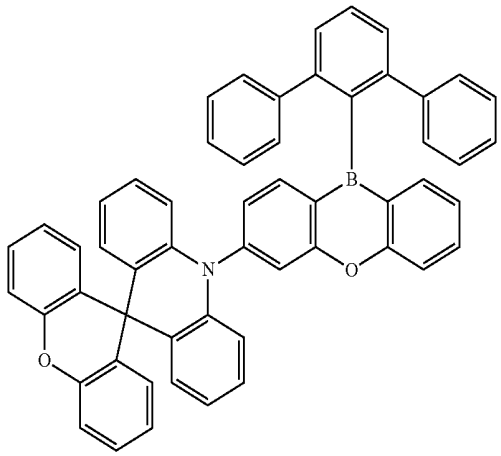

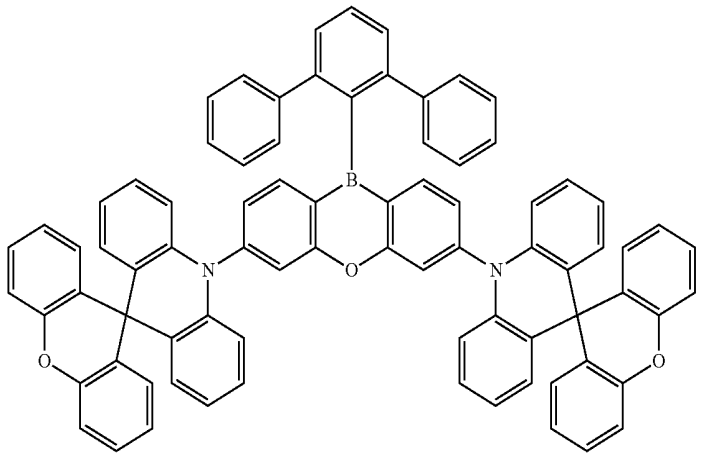

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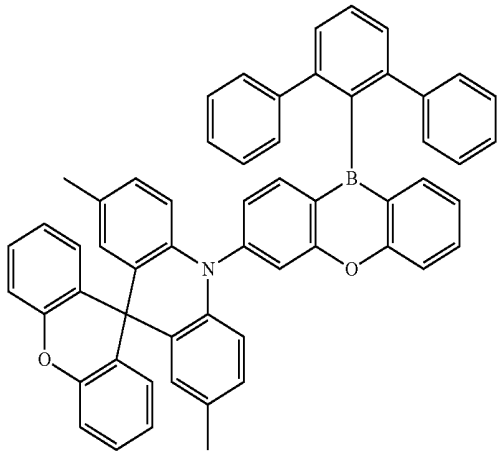

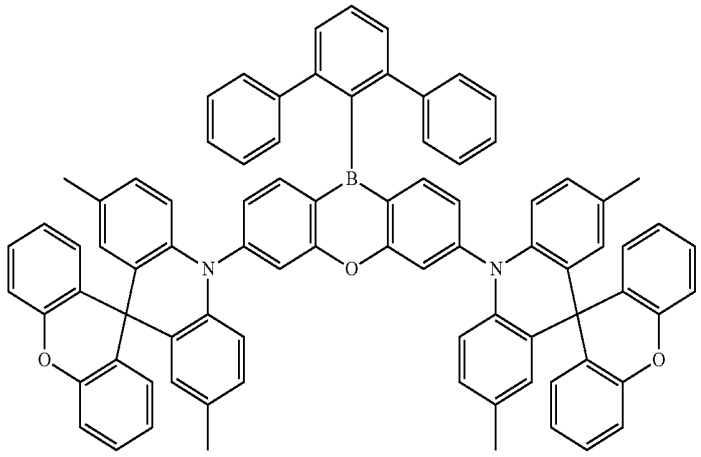

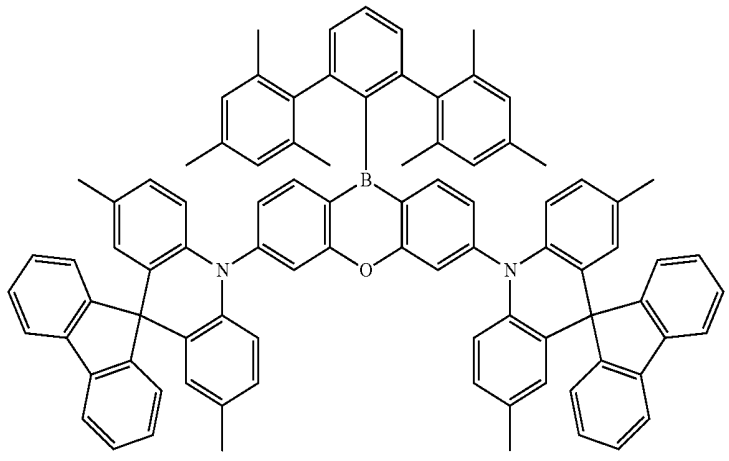

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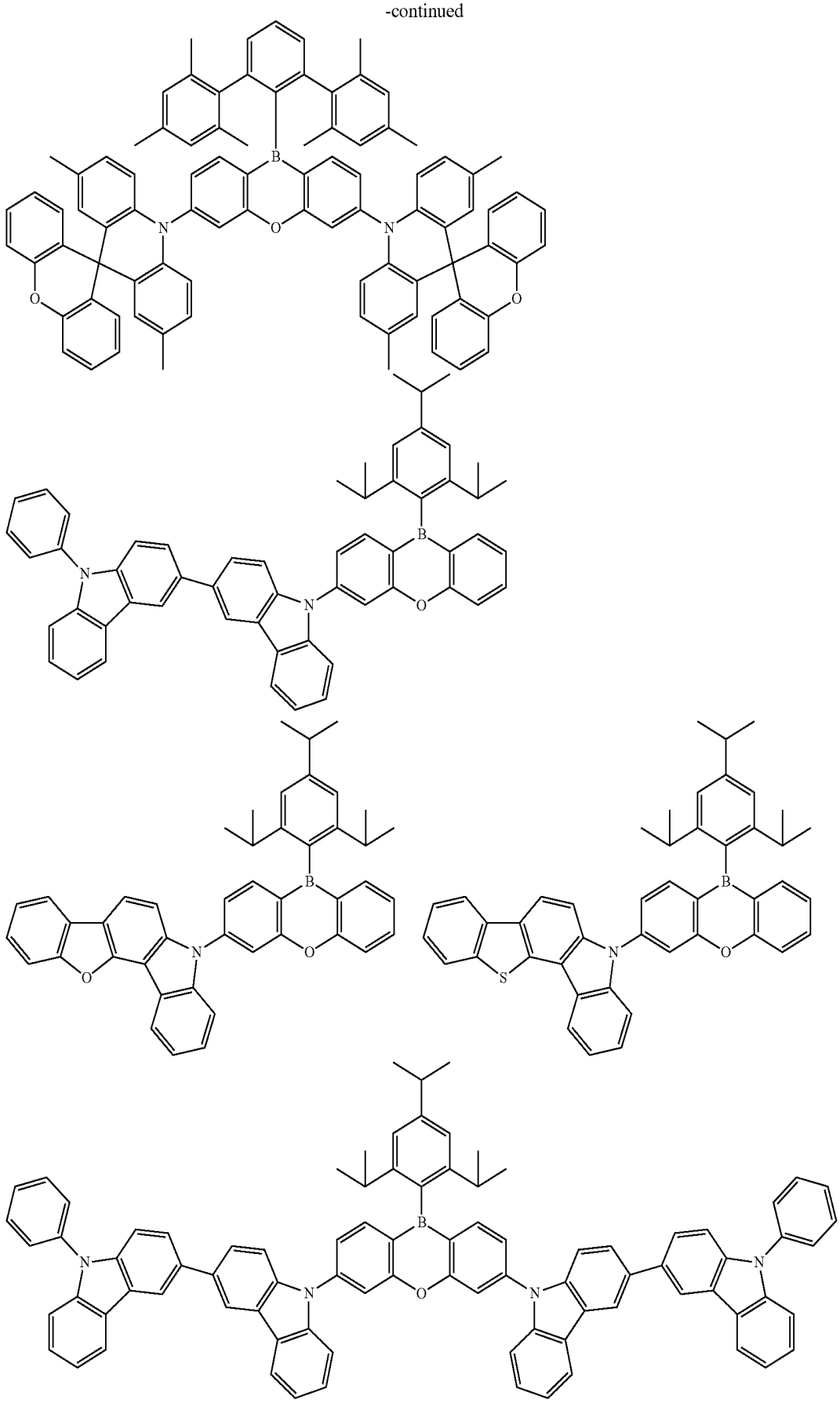

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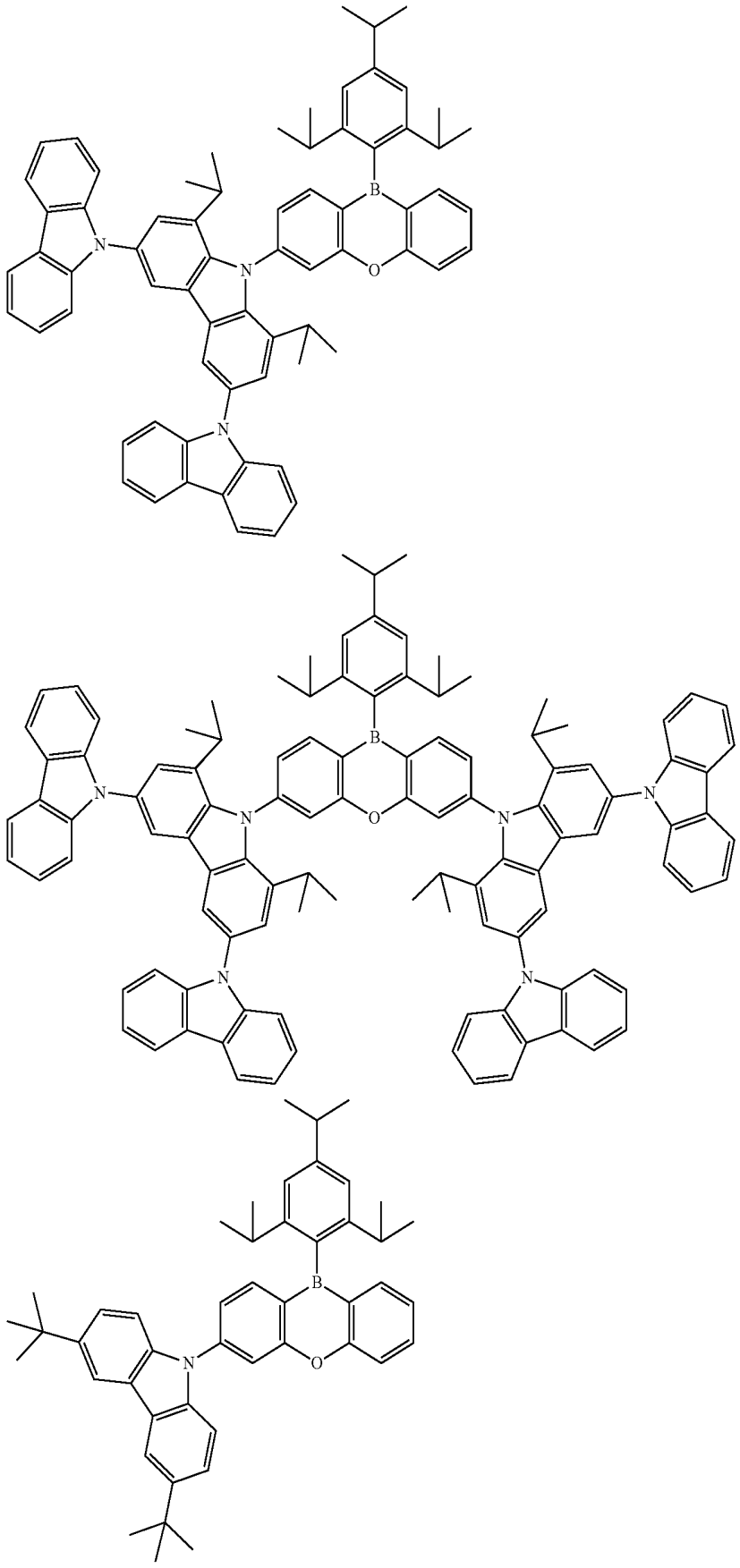

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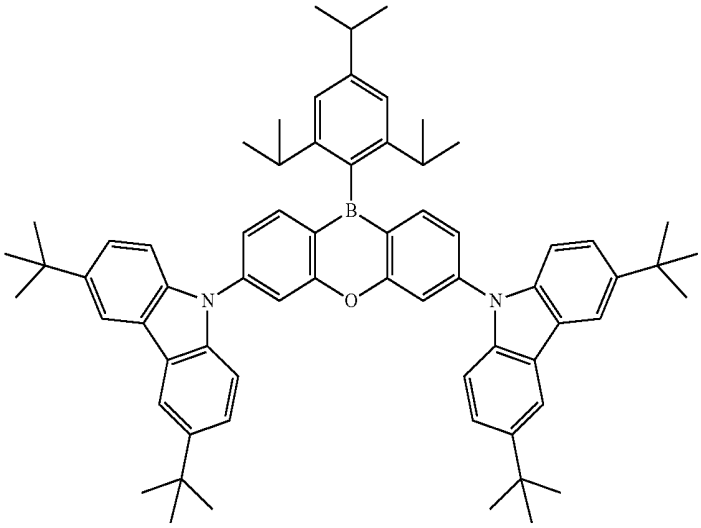

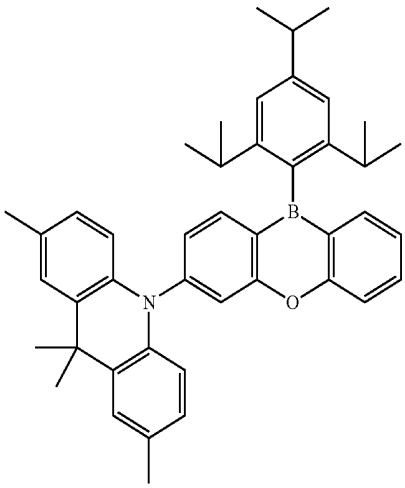

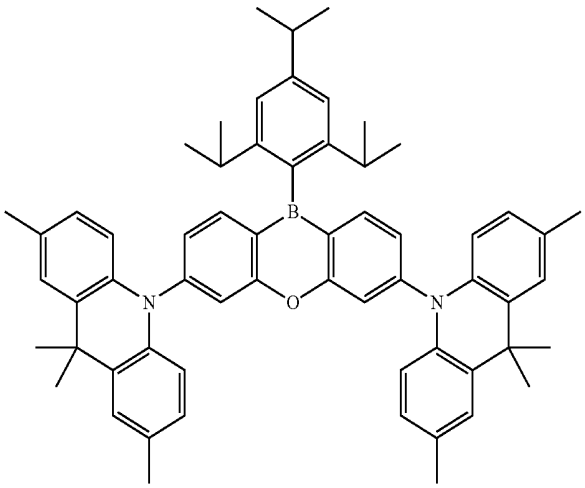

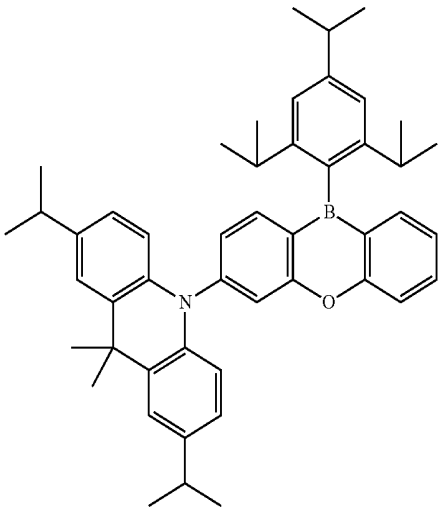

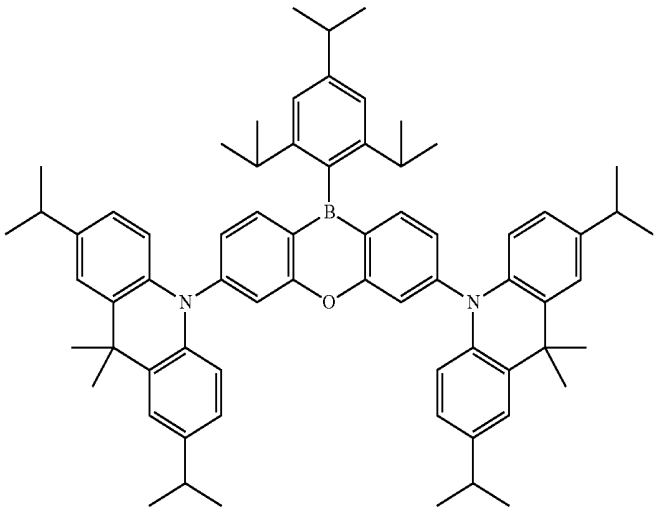

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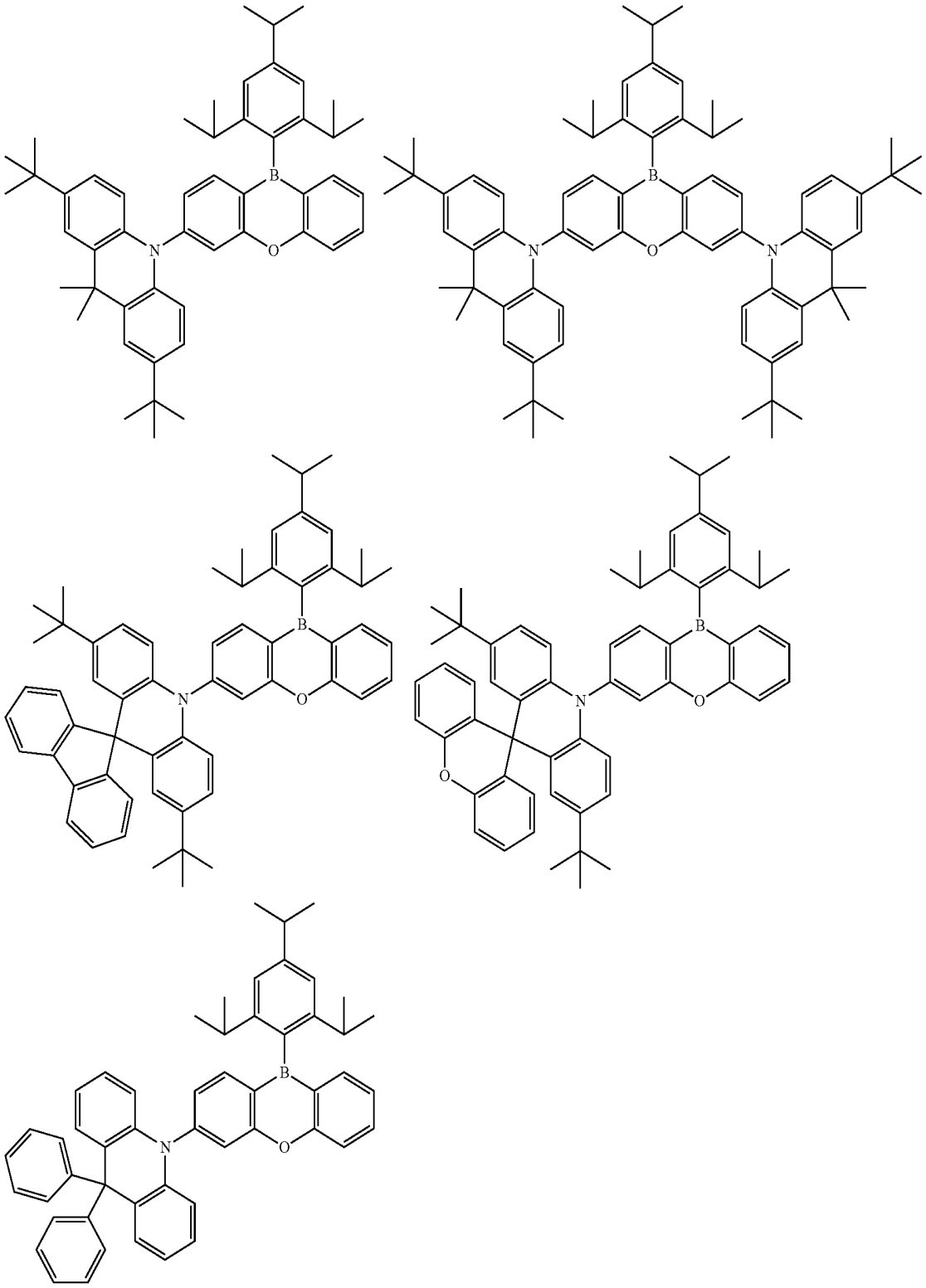

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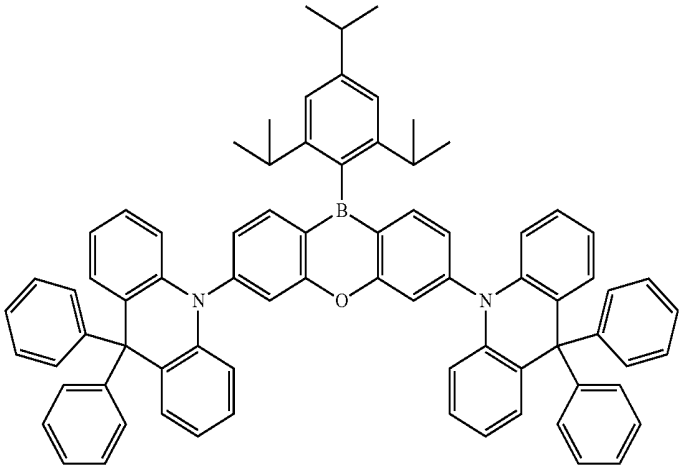

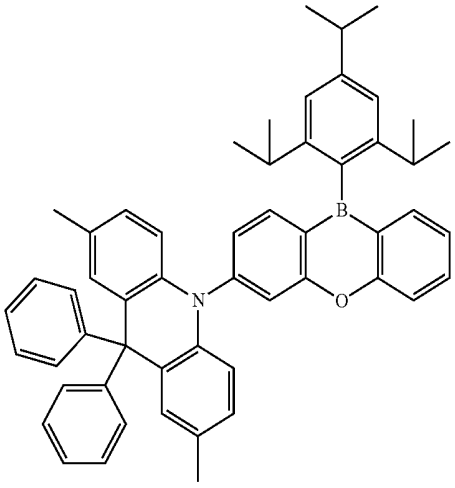

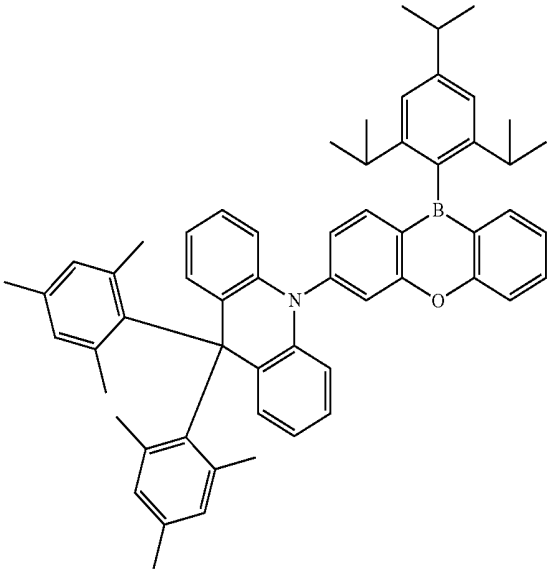

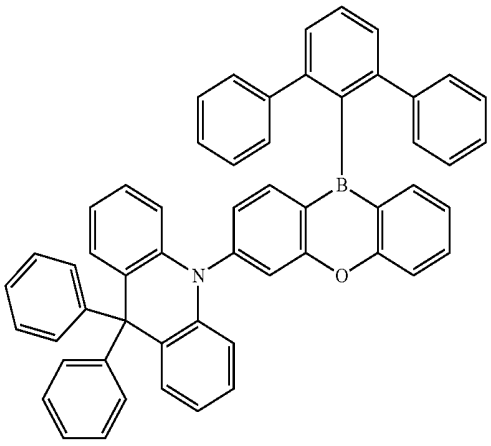

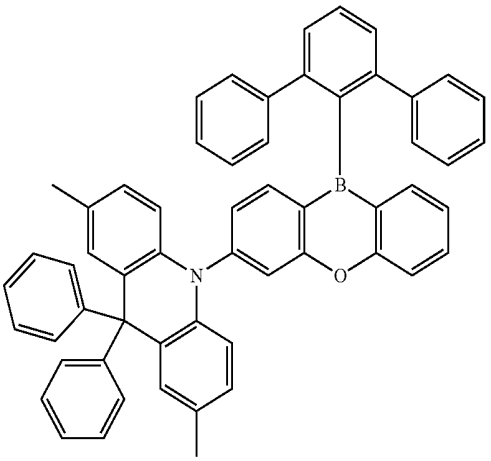

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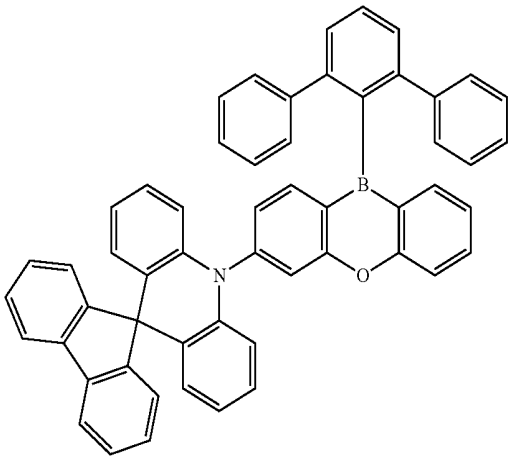
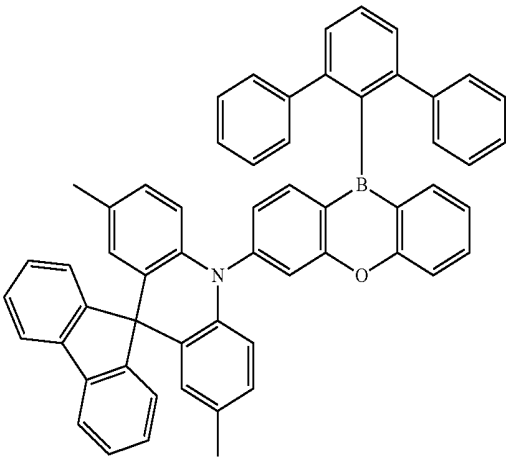
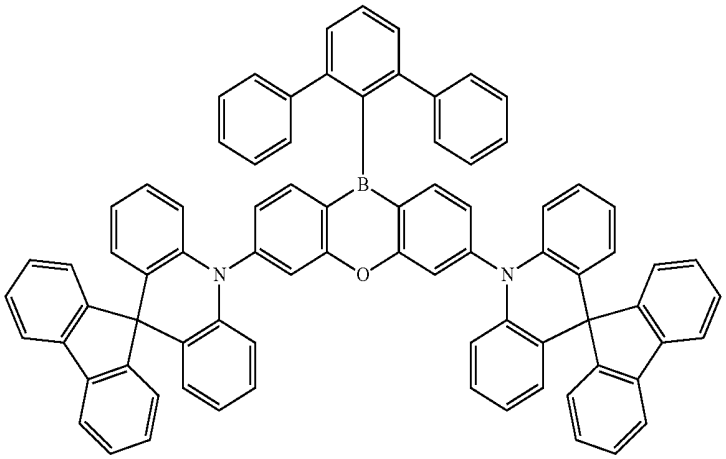
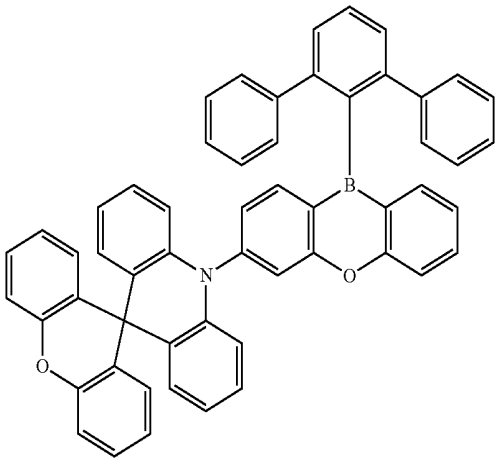
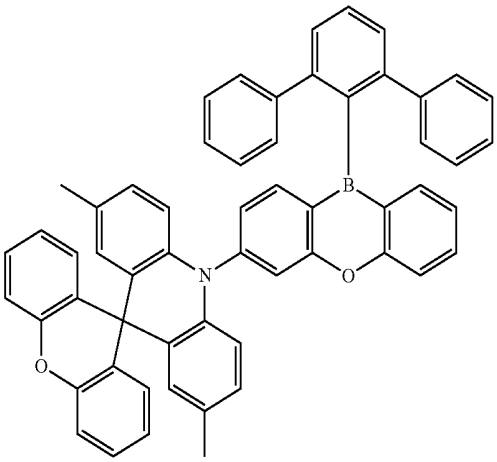

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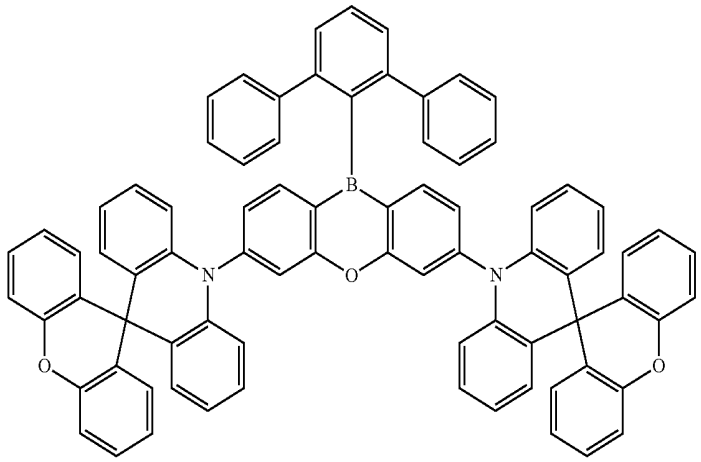

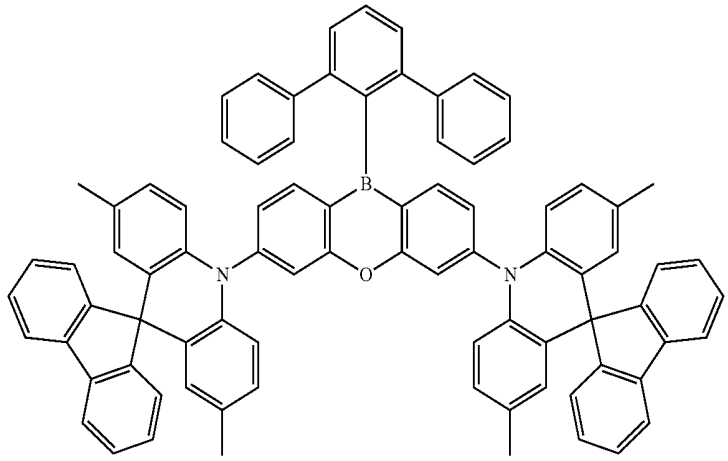

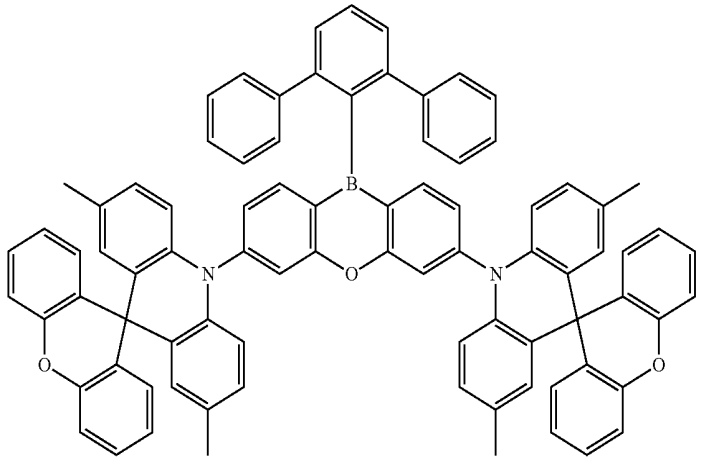

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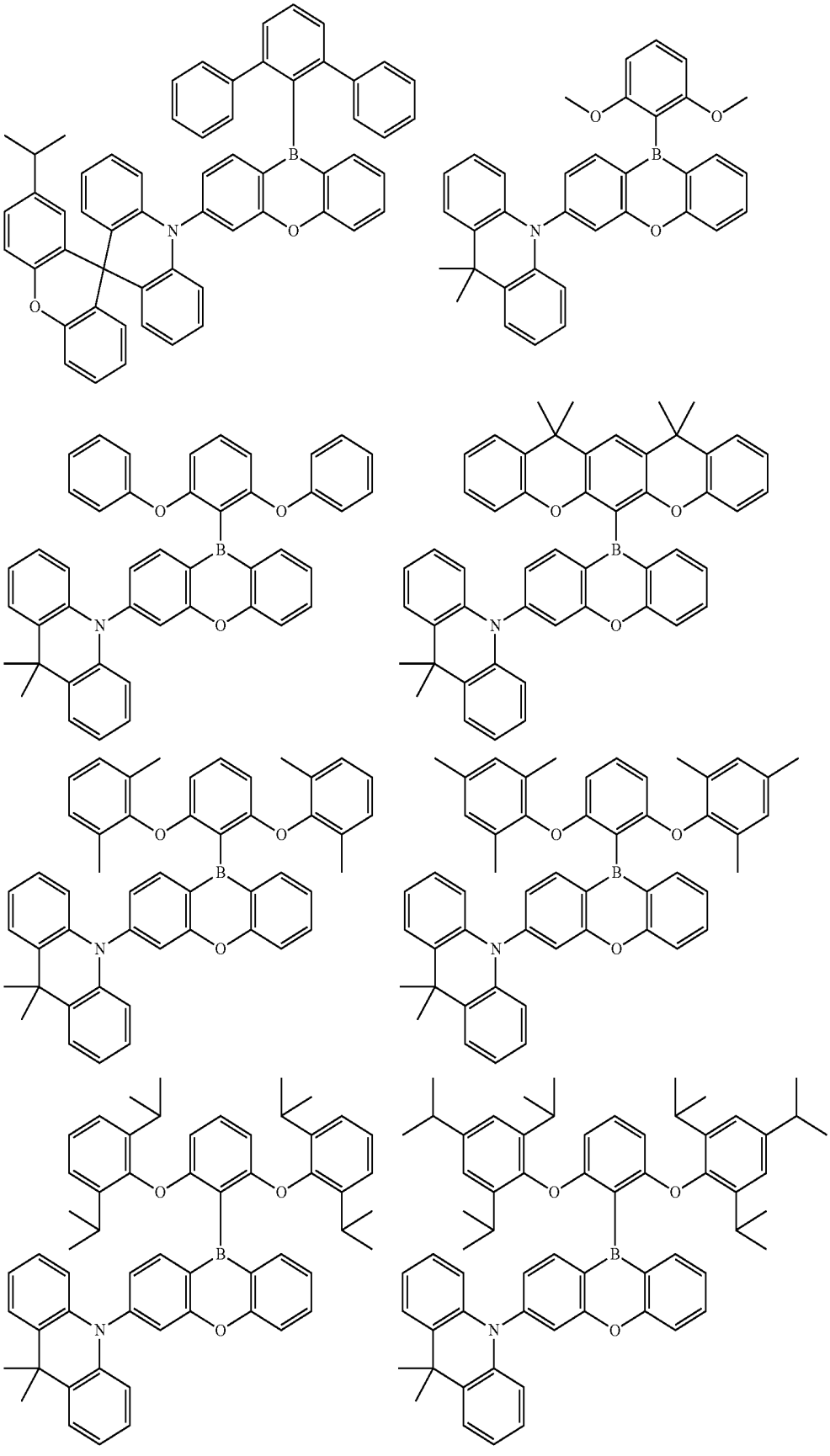

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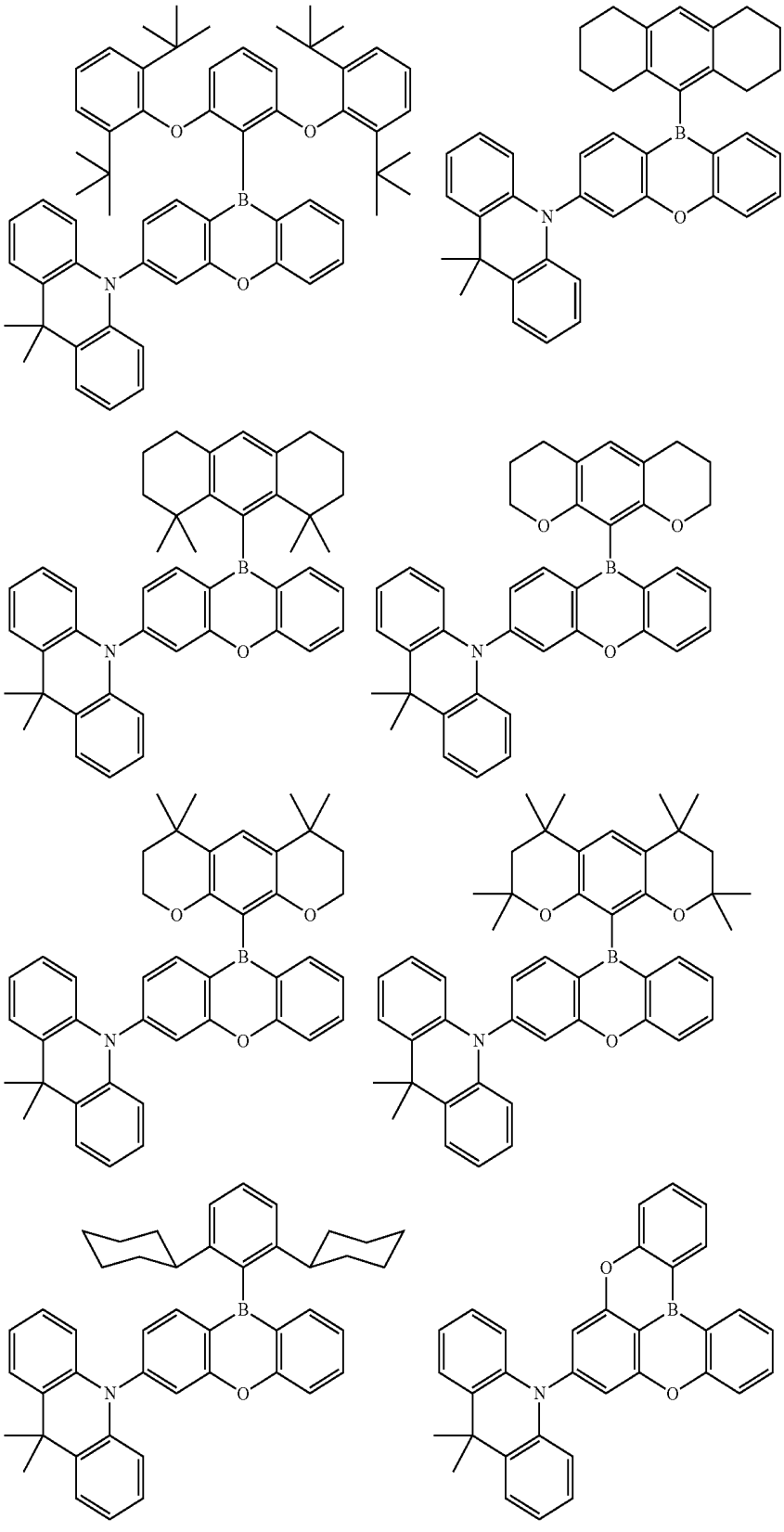

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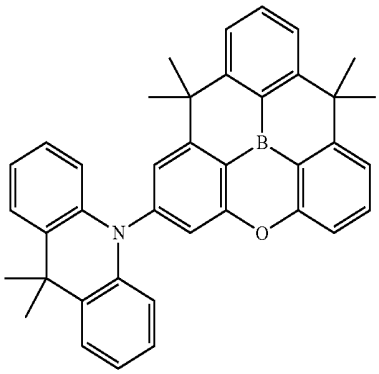

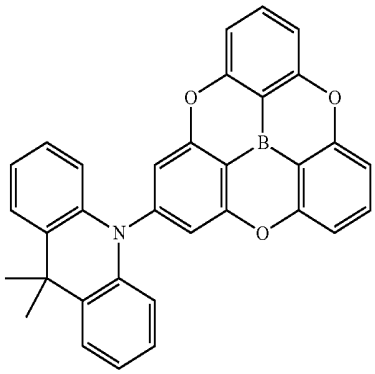

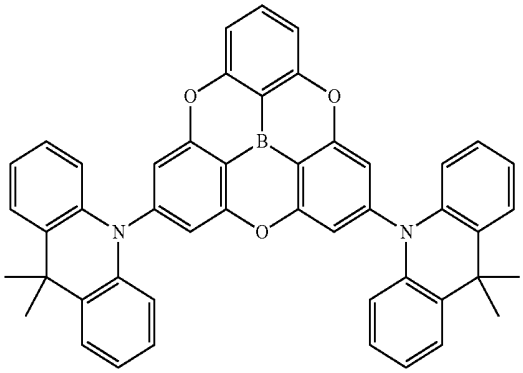

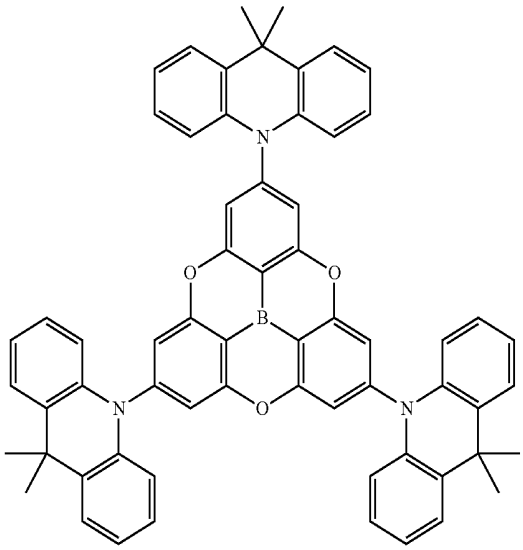

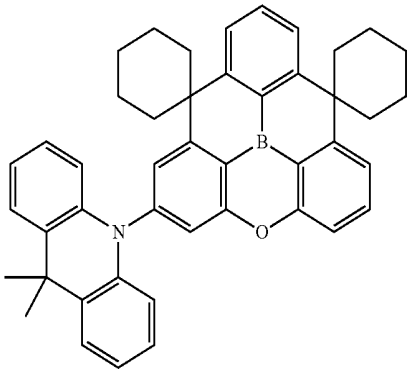

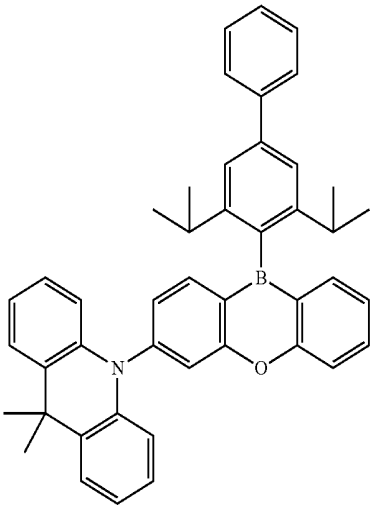

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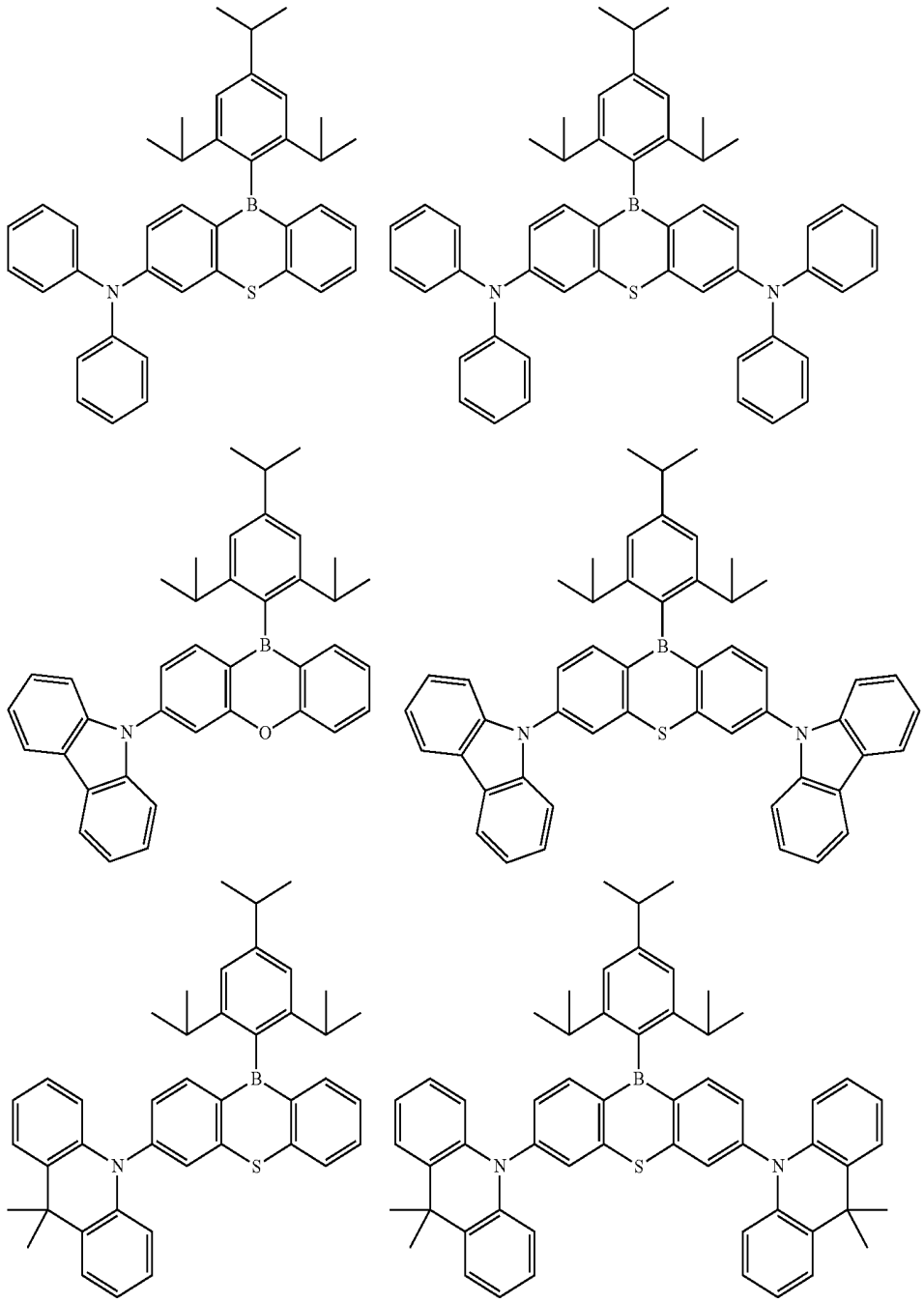

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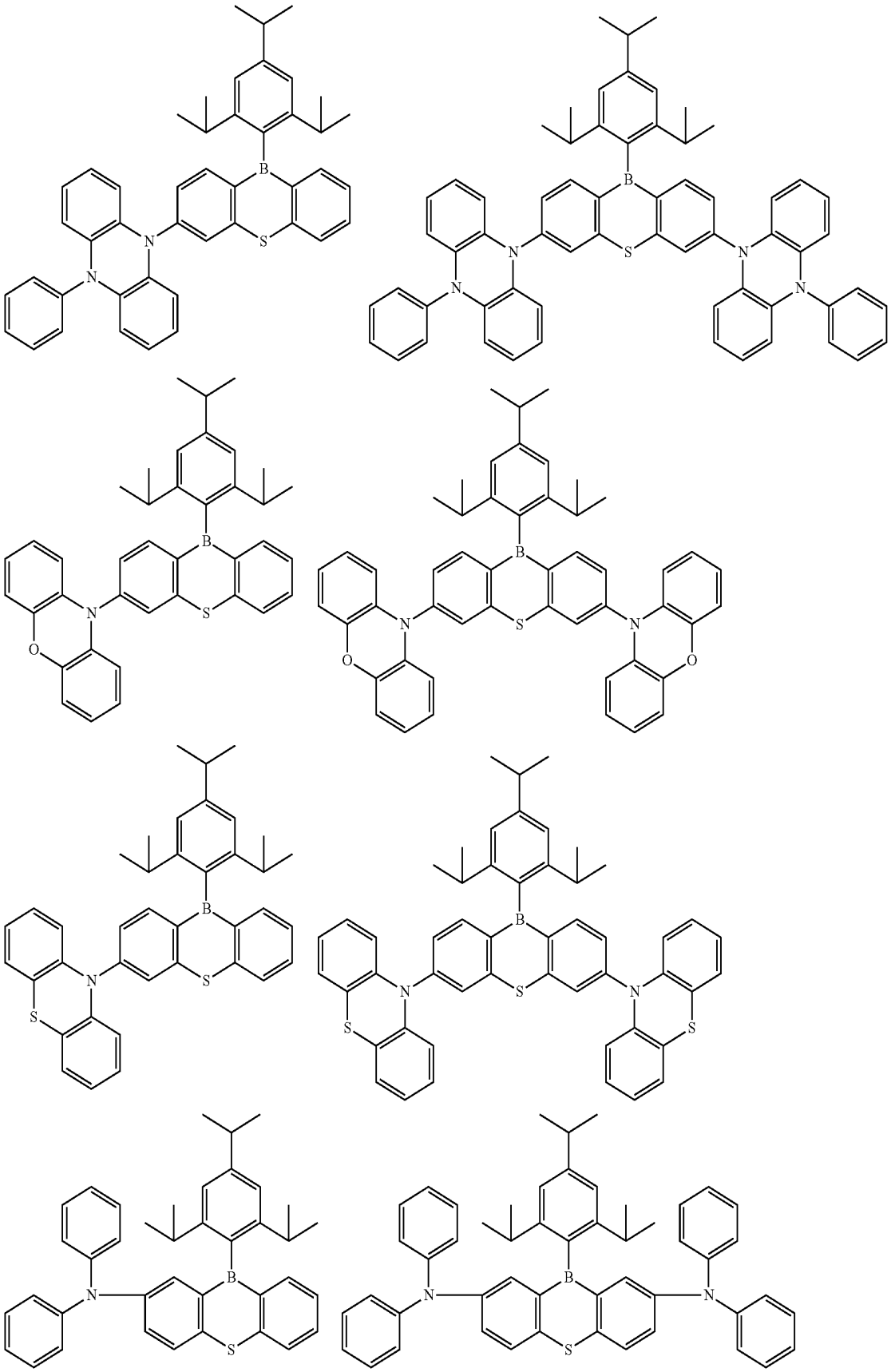

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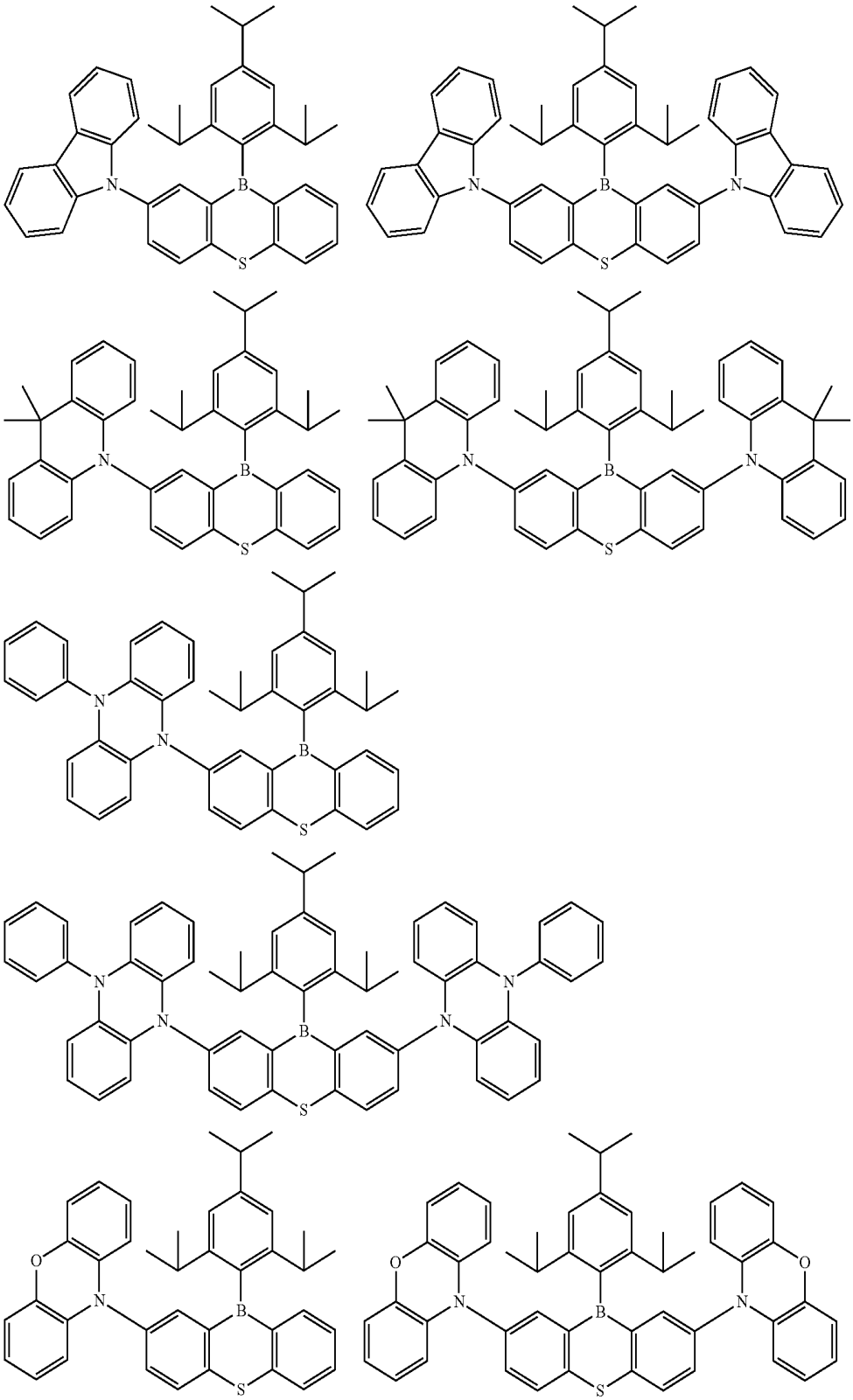

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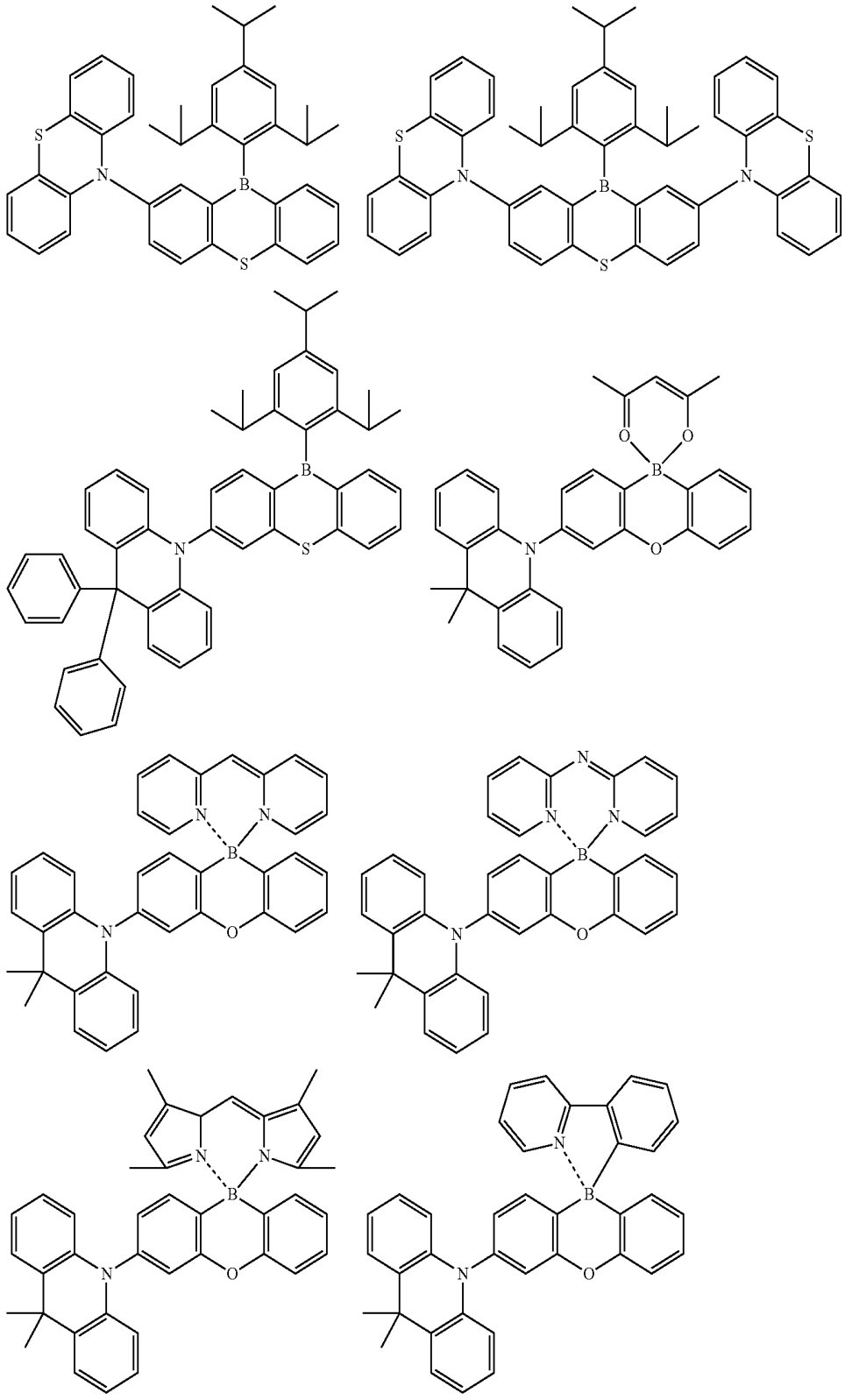

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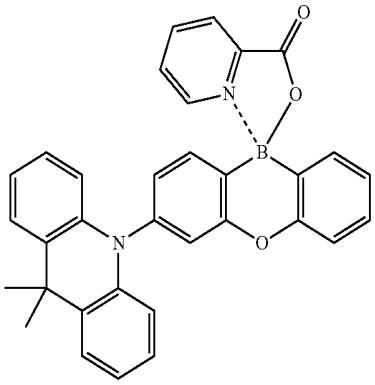

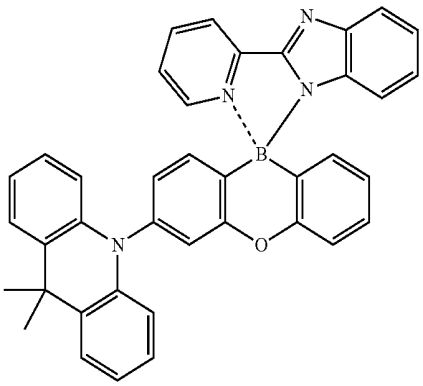

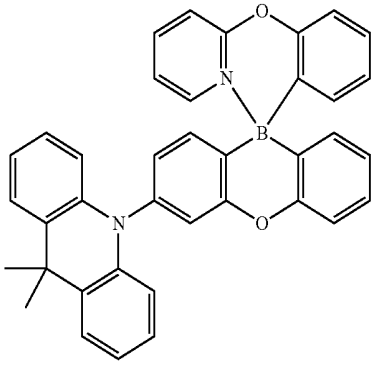

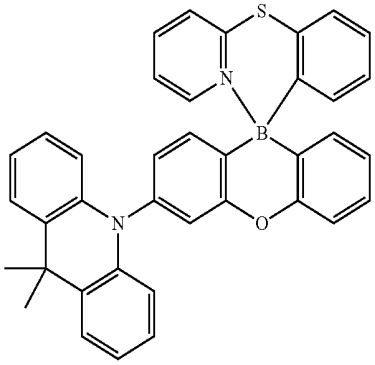

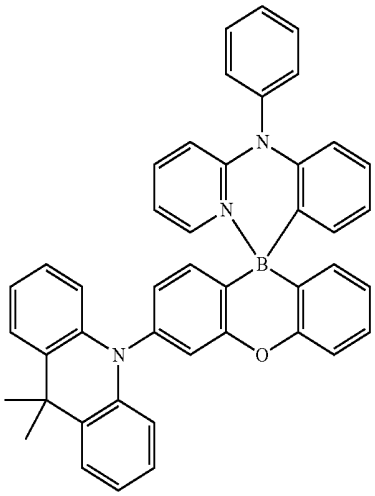

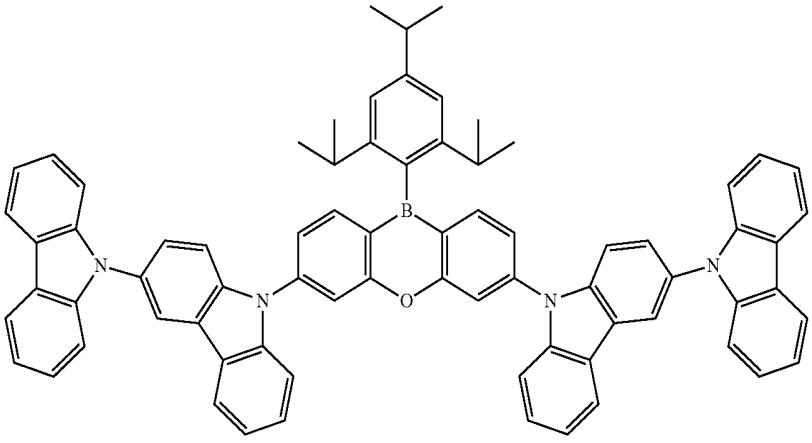

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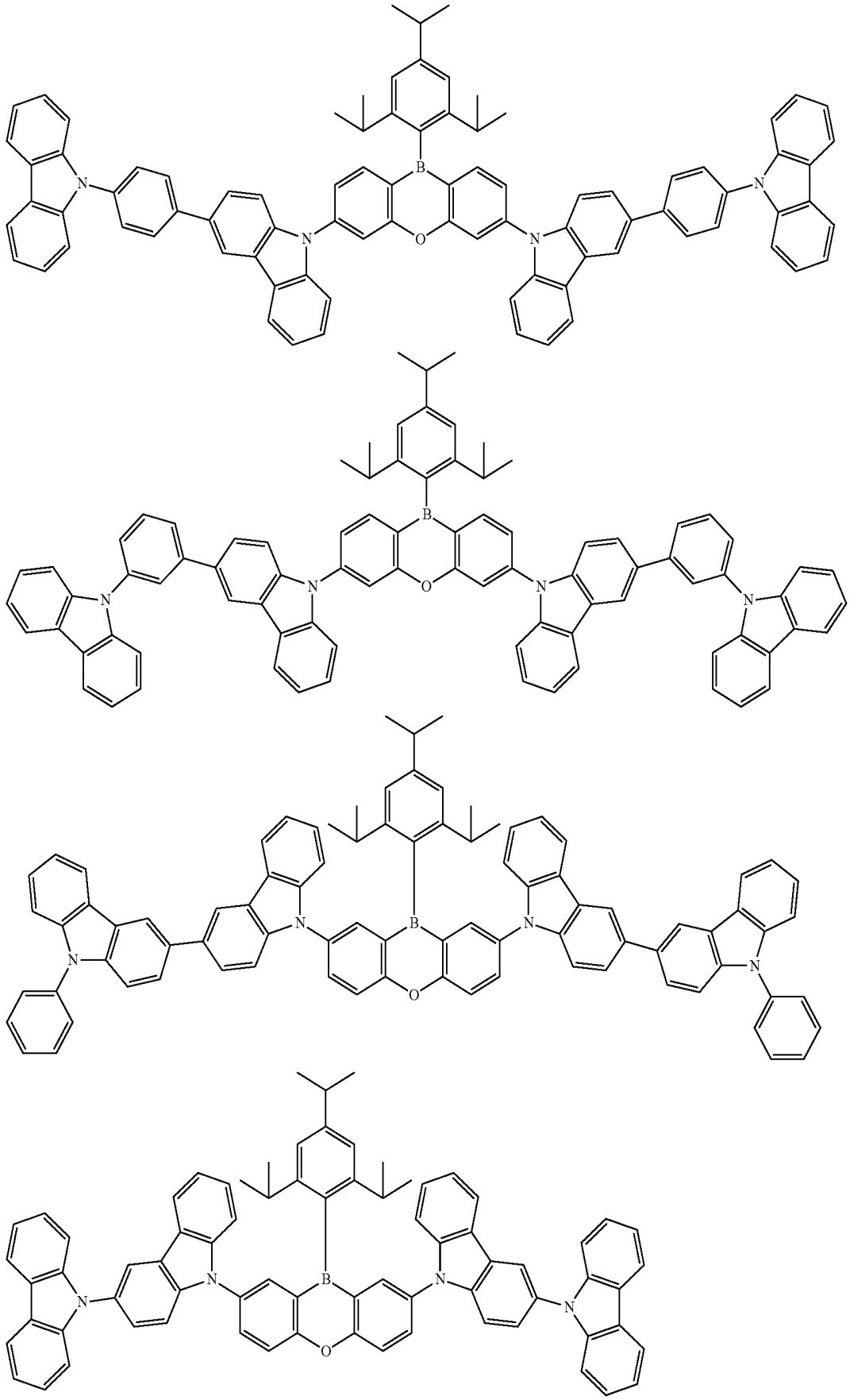

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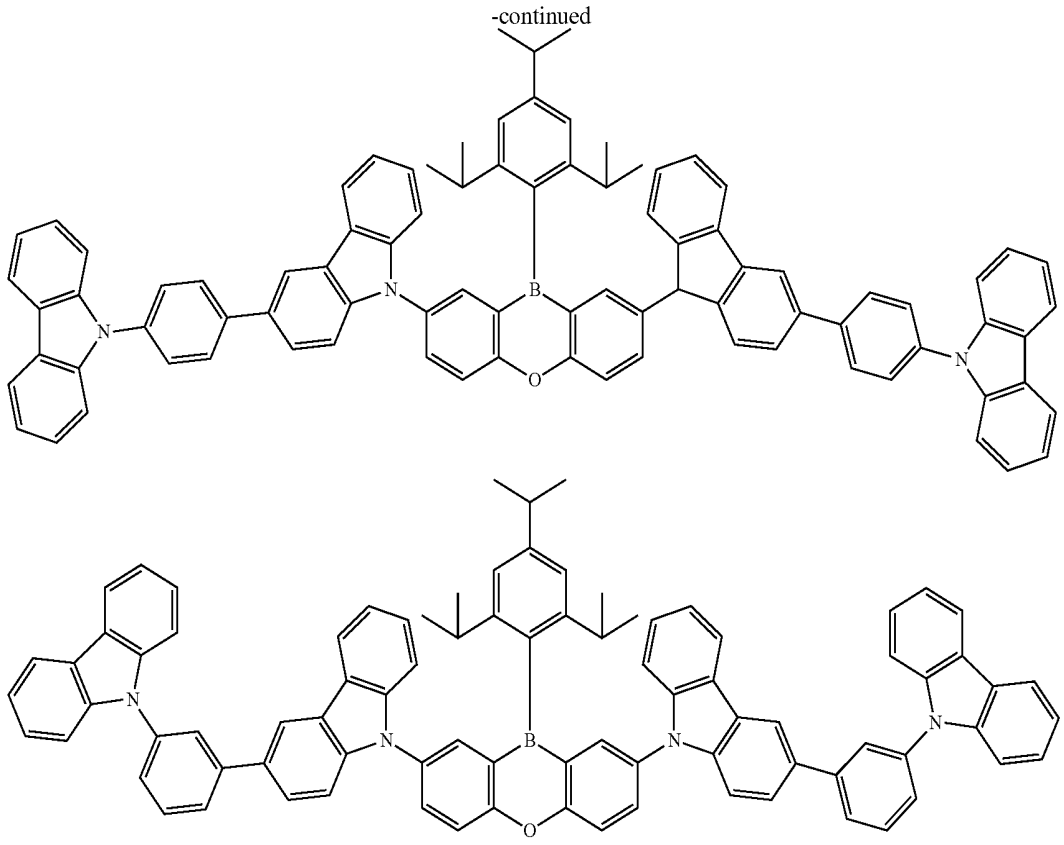
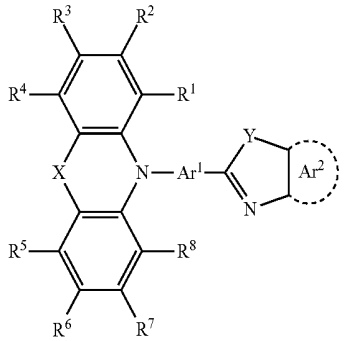


[0204] Examples of the preferred light-emitting material include the following compounds.

[0205] (1) A compound represented by the following general formula (291):

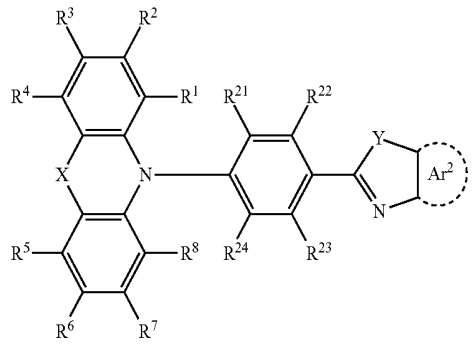
General Formula (291)



wherein in the general formula (291), X represents O, S, N—R^{11}, C═O, C(R^{12})(R^{13}), or Si(R^{14})(R^{15}); Y represents O, S, or N—R^{16}; Ar^1 represents a substituted or unsubstituted arylene group; Ar^2 represents an aromatic ring or a heteroaromatic ring; and R^1 to R^8 and R^{11} to R^{16} each independently represent a hydrogen atom or a substituent, in which R^1 and R^2, R^2 and R^3, R^3 and R^4, R^5 and R^6, R^6 and R^7, and R^7 and R^8 each may foe bonded to each other to form a cyclic structure.

[0206] (2) The compound according to the item (1), wherein the compound represented by the general formula (291) is a compound represented by the following general formula (292):

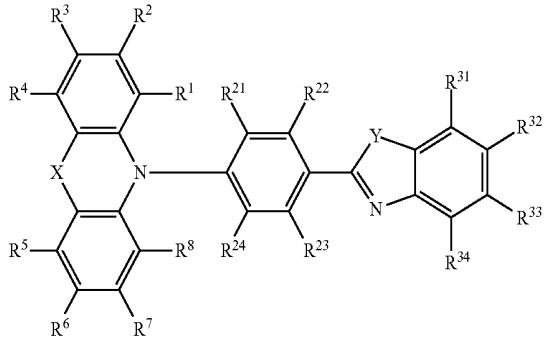
General Formula (292)



wherein in the general formula (292), X represents O, S, N—R^{11}, C═O, C(R^{11})(R^{13}), or Si(R^{14})(R^{15}); Y represents O, S, or N—R^{16}; Ar^2 represents an aromatic ring or a heteroaromatic ring; and R^1 to R^8, R^{11} to R^{16}, and R^{21} to R^{24} each Independently represent a hydrogen atom or a substituent, in which R^1 and R^2, R^2 and R^3, R^3 and R^4, R^5 and R^6, R^6 and R^7, R^7 and R^8, R^{21} and R^{22}, and R^{23} and R^{24} each may be bonded to each other to form a cyclic structure.

[0207] (3) The compound according to the item (1), wherein the compound represented by the general formula (391) is a compound represented by the following general formula (293):

General Formula (293)



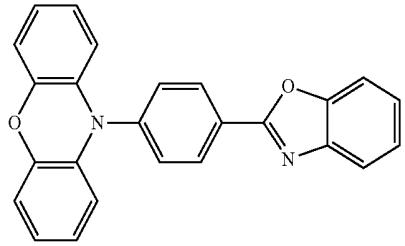
wherein in the general formula (293), X represents O, S, N—R^{11}, C═O, C(R^{12}) (R^{14}), or Si(R^{14}) (R^{15}); Y represents O, S, or N—R^{16}; and R^1 to R^8, R^{11} to R^{16}, R^{21} to R^{24}, and R^{31} to R^{34} each independently represent a hydrogen atom or a substituent, in which R^1 and R^2, R^2 and R^3, R^3 and R^4, R^4 and R^5, R^6 and R^7, R^7 and R^8, R^{21} and R^{22}, R^{23} and R^{24}, R^{31} and R^{32}, R^{32} and R^{33}, and R^{33} and R^{34} each stay be bonded to each other to form a cyclic structure.

[0208] (4) The compound according to any one of the items (1) to (3), wherein X represents O or S.

[0209] (5) The compound according to any one of the items (1) to (4), wherein X represents O, S, or N—R^{16}, and R^{16} represents a substituted or unsubstituted aryl group.

[0210] (6) The compound according to any one of the items (1) to (5), wherein R^1 to R^8 each independently represent a hydrogen atom, a fluorine atom, a chlorine atom, a cyano group, a substituted or unsubstituted alkyl group having from 1 to 10 carbon atoms, a substituted or unsubstituted alkoxy group having from 1 to 10 carbon atoms, a substituted or unsubstituted dialkylamino group having from 1 to 10 cartoon atoms, a substituted or unsubstituted diarylamino group having from 12 to 40 carbon atoms, a substituted or unsubstituted aryl group having from 6 to 15 carbon atoms, a substituted or unsubstituted heteroaryl group having from 3 to 12 carbon atoms.

[0211] Examples of the compound include the following compounds.



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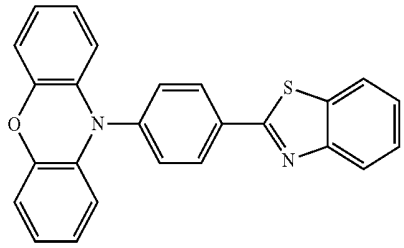

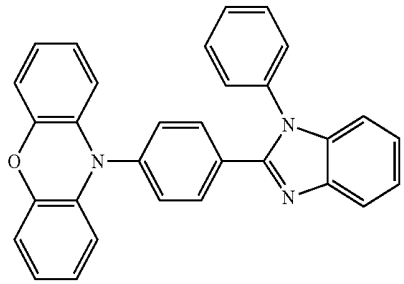

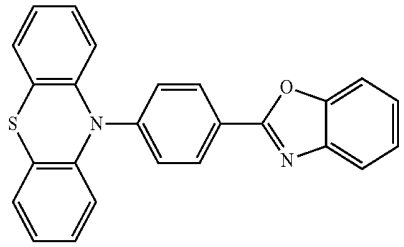

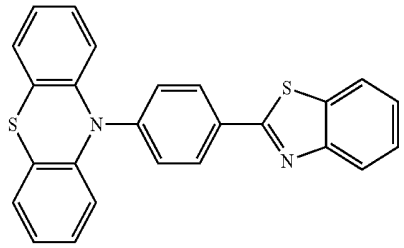

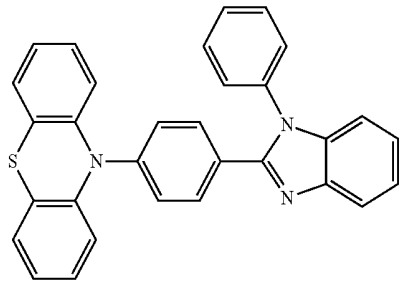

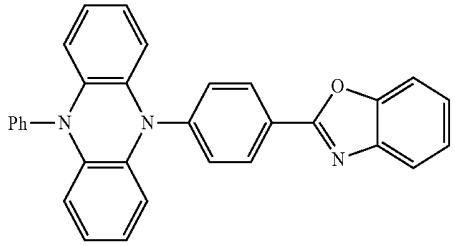

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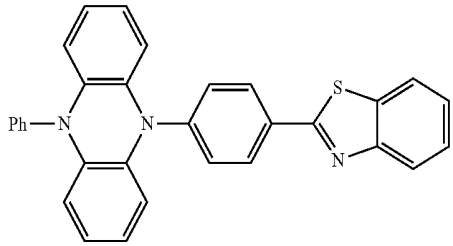

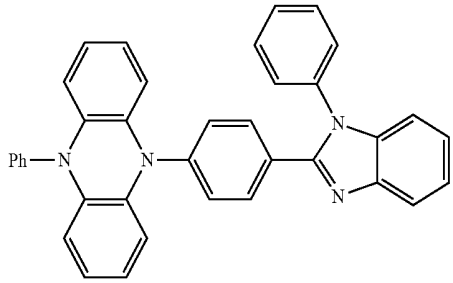

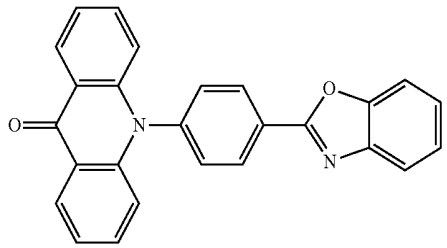

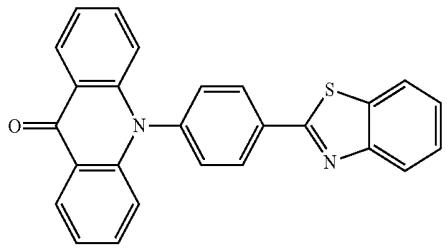

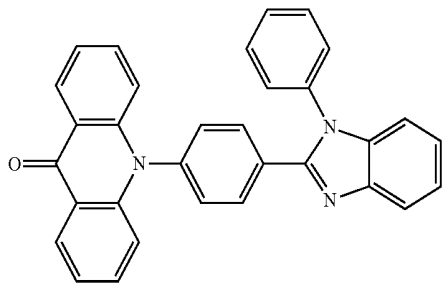

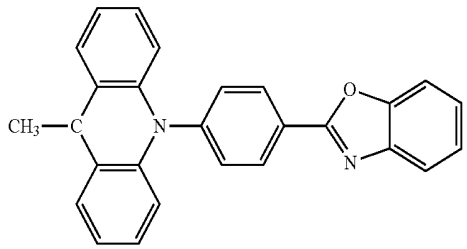

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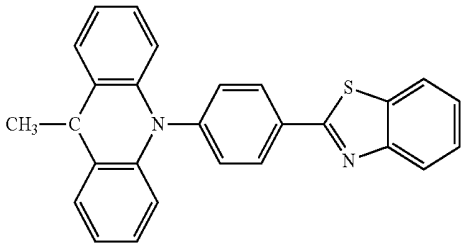
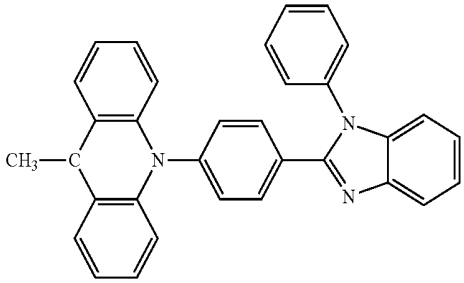
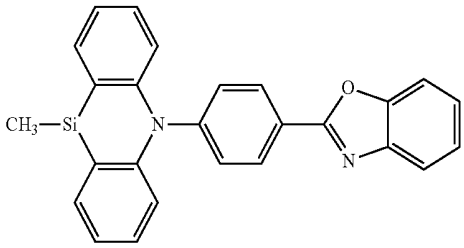
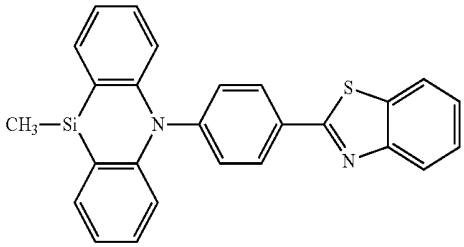
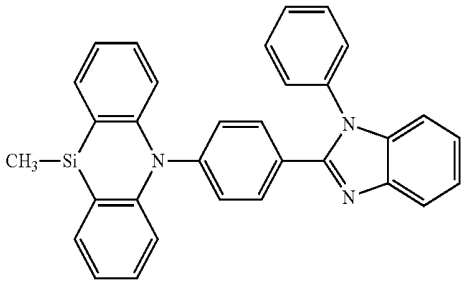










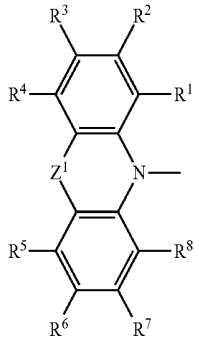
[0212] Examples of the preferred light-emitting material include the following compounds.

[0213] (1) A compound represented by the following general formula (301):

$(D)_n$-A General Formula (301)

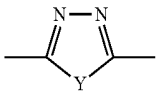
wherein in the general formula (301), D represents a group represented by the following general formula (302); A represents an n-valent group containing a structure represented by the following general formula (303); and n represents an integer of from 1 to 8:

General Formula (302)



wherein in the general formula (303) Z^1 represents O, S, C═O, $C(R^{21})(R^{22})$, $Si(R^{23})(R^{24})$, N—Ar^3, or a single bond; R^{21} to R^{24} each independently represent an alkyl croup having from 1 to 8 carbon atoms; Ar^3 represents a (substituted or unsubstituted aryl group; and R^1 to R^8 each independently represent a hydrogen atom or a substituent, in which R^1 and R^2, R^2 and R^3, R^3 and R^4, R^5 and R^6, R^6 and R^7, and R^7 and R^8 may be bonded to each other to form a cyclic structure, and when Z^1 represents a single bond, at least one of R^1 to R^8 represents a substituted or unsubstituted diarylamino group:

General Formula (303)



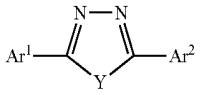
wherein in the general formula (303), Y represents O, S, or N—Ar^4; and Ar^4 represents a substituted or unsubstituted aryl group.

[0214] (2) The compound according co the item (1), wherein in the general formula (302), Z^1 represents O, S, C═O, $C(R^{21})(R^{22})$, $Si(R^{23})(R^{24})$, or a single bond.

[0215] (3) The compound according to the item (1), wherein in the general formula (302), Z^1 represents N—Ar^3.

[0216] (4) The compound according to any one of the items (1) to (3), wherein in the general formula (301), A has a structure represented by the following general formula (304):

General Formula (304)

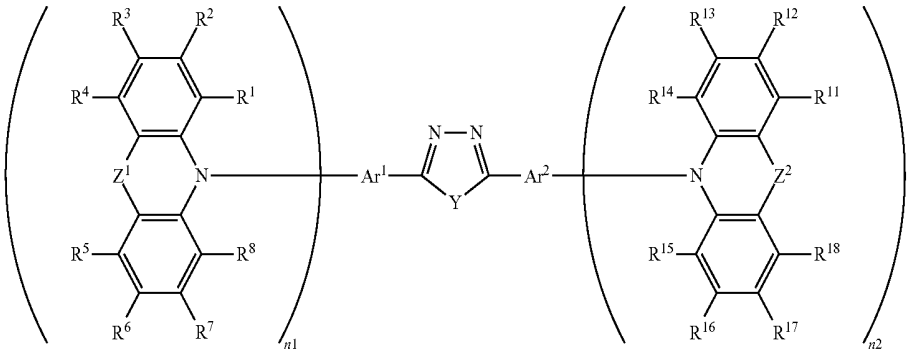


wherein in the general formula (304), X represents O, S, or N—Ar^4; and Ar^1 and Ar^2 each independently represent a substituted or unsubstituted aromatic group.

[0217] (5) The compound according to any one of the items (1) to (4), wherein in the general formula (301), n represents an integer of from 1 to 4.

[0218] (6) The compound according to any one of the items (2) to (3), wherein the compound is represented by the following general formula (305):

General Formula (305)



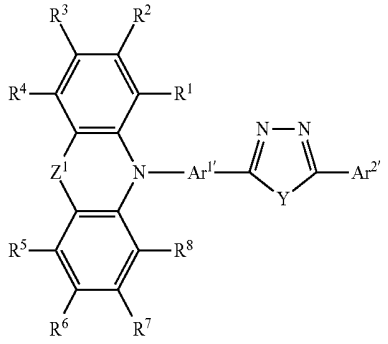
wherein in the general formula (305), Z^1 and Z^2 each independently represent O, S, C═O, $C(R^{21})(R^{22})$, $Si(R^{23})(R^{24})$, N—Ar^3, or a single bond; R^{21} to R^{24} each independently represent an alkyl group having from 1 to 8 carbon atoms; Ar^3 represents a substituted or unsubstituted aryl group; Ar^1 and Ar^2 each independently represent a substituted or unsubstituted aromatic group; Y represents O, S, or N—Ar^4; Ar^4 represents a substituted or unsubstituted aryl group; R^1 to R^6 and R^{11} to R^{18} each independently represent a hydrogen atom or a substituent, in which R^1 and R^2, R^2 and R^3, R^3 and R^4, R^5 and R^6, R^6 and R^7, R^7 and R^8, R^{11} and R^{12}, R^{12} and R^{13}, R^{13} and R^{14}, R^{15} and R^{16}, R^{16} and R^{17}, and R^{17} and R^{18} each may be bonded to each other to form a cyclic structure, provided that when Z^1 represents a single bond, at least one of R^1 to R^8 represents a substituted or unsubstituted diarylamino group, and when Z^2 represents a single bond, at least one of R^{11} to R^{18} represents a substituted or unsubstituted diarylamino group; and n1 and n2 each independently represent an integer of from 0 to 8, provided that the sum of n1 and n2 is from 1 to 8.

[0219] (7) The compound according to the item (6), wherein in the general formula (305), Z^1 and Z^2 each independently represent O, S, N—Ar^3, or a single bond.

[0220] (8) The compound according to the item (6) or (7), wherein in the general formula (305), Y represents O or N—Ar^4.

[0221] (9) The compound according to any one of the items (1) to (3), wherein the compound is represented by the following general formula (306):

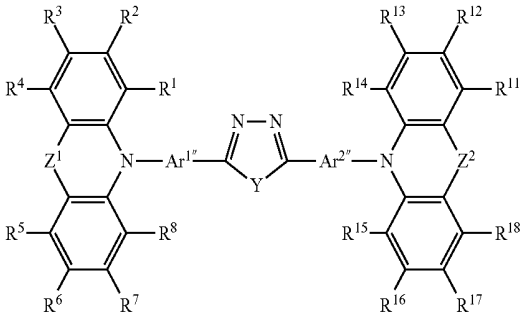
General Formula (306)



wherein in the general formula (306), Z^1 represent a O, S, C═O, $C(R^{21})(R^{22})$, $Si(R^{23})(R^{24})$, N—Ar^3, or a single bond; R^{21} to R^{24} each independently represent an alkyl group having from 1 to 8 carbon atoms; Ar^3 represents a substituted or unsubstituted aryl group; $Ar^{1'}$ represents a substituted or unsubstituted arylene group; $Ar^{2'}$ represents a substituted or unsubstituted aryl group; Y represents O, S, or N—Ar^4; Ar^4 represents a substituted or unsubstituted aryl group; and R^1 to R^6 each independently represent a hydrogen atom, or a substituent, in which R^1 and R^2, R^2 and R^3, R^3 and R^4, R^5 and R^6, R^6 and R^7, and R^7 and R^8 each may be bonded to each other to form a cyclic structure, provided that when Z^1 represents a single bond, at least one of R^1 to R^8 represents a substituted or unsubstituted diarylamino group.

[0222] (10) The compound according to any one of the items (1) to (3), wherein the compound is represented by the following general formula (307):

General Formula (307)

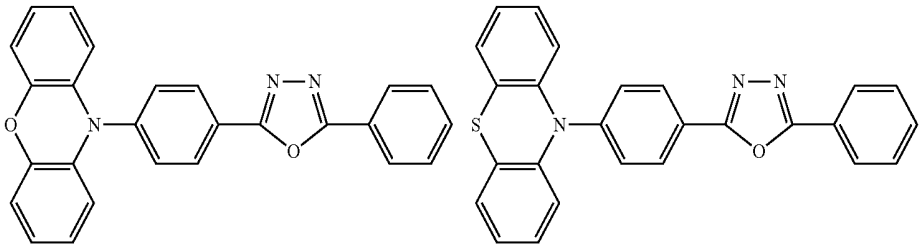


wherein in the general formula (307), Z^1 and Z^2 each independently represent O, S, C═O, $C(R^{21})(R^{22})$, $Si(R^{23})(R^{24})$, N—Ar^3, or a single bond; R^{21} to R^{24} each independently represent an alkyl group having from 1 to 8 carbon atoms; Ar^3 represents a substituted or unsubstituted aryl group; $Ar^{1''}$ and $Ar^{2''}$ each independently represent a substituted or unsubstituted arylene group; Y represents O, S, or N—Ar^4; Ar^4 represents a substituted or unsubstituted aryl group; and R^1 to R^8 and R^{11} to R^{18} each independently represent a hydrogen atom or a substituent, in which R^1 and R^2, R^2 and R^3, R^3 and R^4, R^5 and R^6, R^6 and R^7, R^7 and R^8, R^{11} and R^{12}, R^{12} and R^{13}, R^{13} and R^{14}, R^{15} and R^{16}, R^{16} and R^{17}, and R^{17} and R^{18} each may be bonded to each other to form a cyclic structure, provided that when Z^1 represents a single bond, at least one of R^1 to R^8 represents a substituted or unsubstituted diarylamino group, and when Z^2 represents a single bond, at least one of R^{11} to R^{18} represents a substituted or unsubstituted diarylamino group.

[0223] (11) The compound according to the item (10), wherein in the general formula (307), Z^1 and Z^2 are the same as each other, $Ar^{1''}$ and $Ar^{2''}$ are the same as each other, R^1 and R^{14} are the same as each other, R^2 and R^{13} are the same an each other, R^1 and R^{12} are the same as each other, R^4 and R^{11} are the same as each other, R^5 and R^{16} are the same as each other, R^6 and R^{17} are the same as each other, R^7 and R^{16} are the same as each other, and R^8 and R^{15} are the same as each other.

[0224] (12) The compound according to the item (10) or (11), wherein in the general formula (307), Z^1 and Z^2 each independently represent O, S, or N—Ar^3.

[0225] Examples of the compound include the following compounds.



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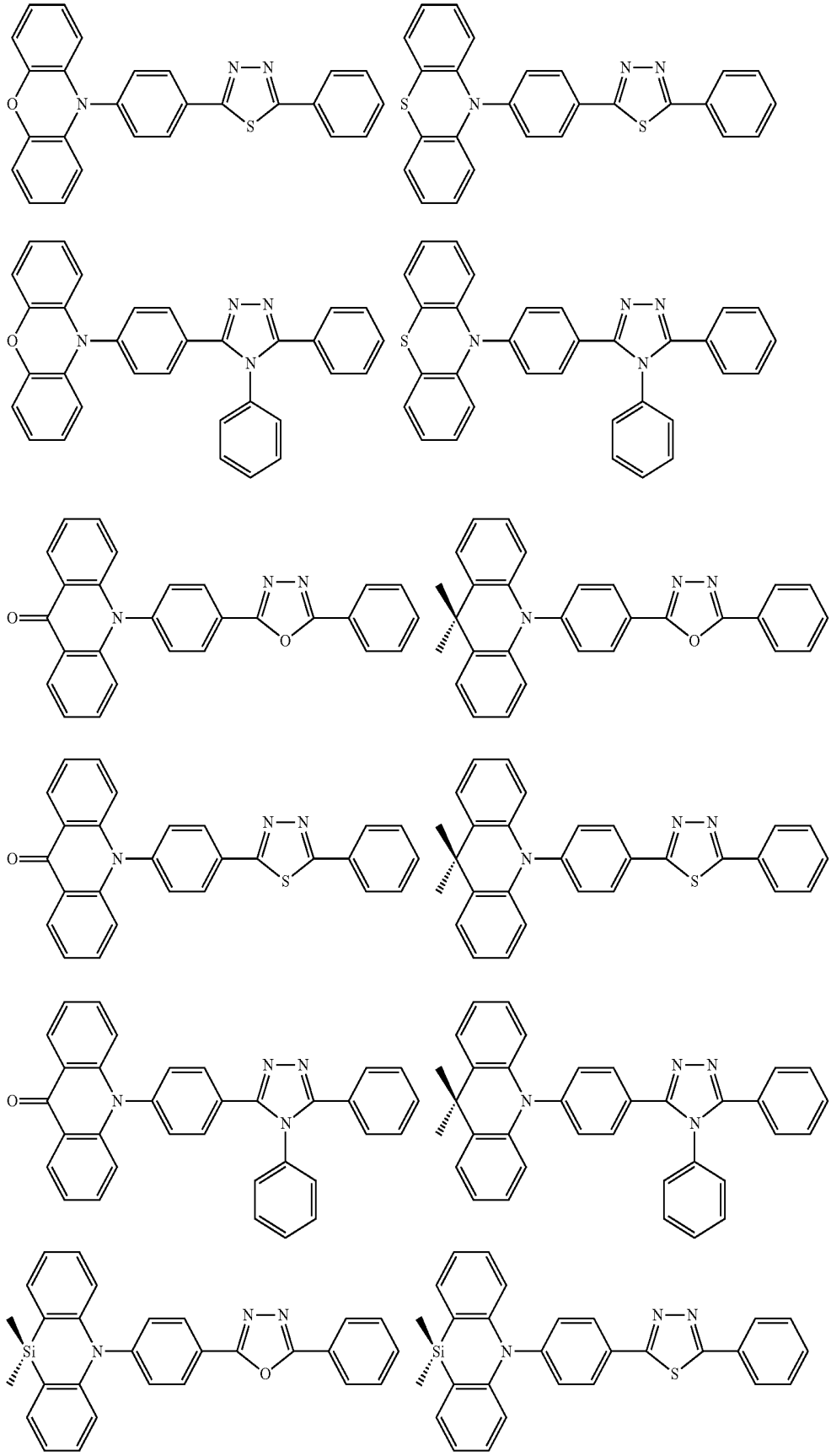

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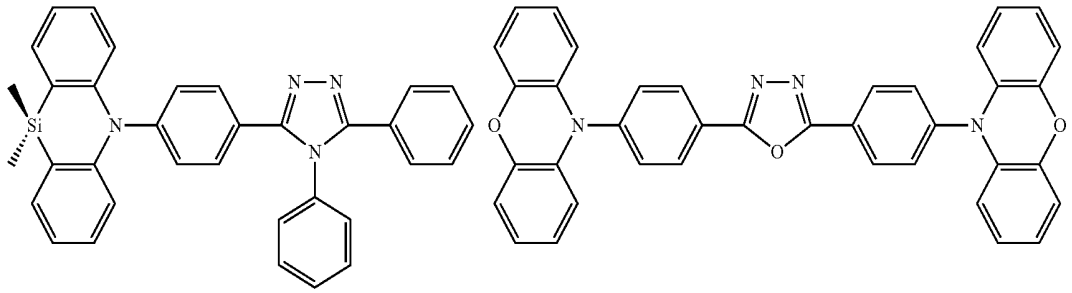

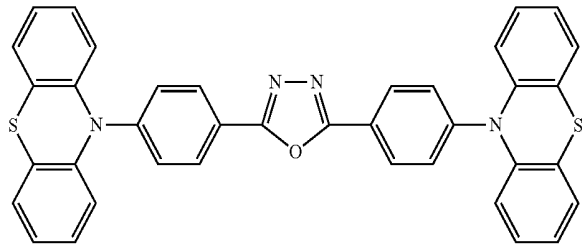

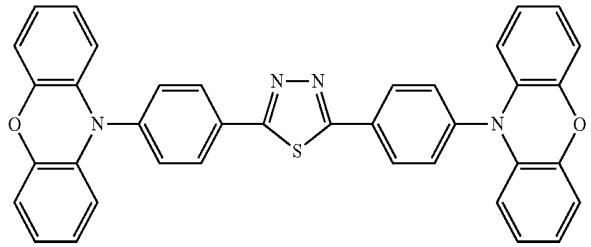

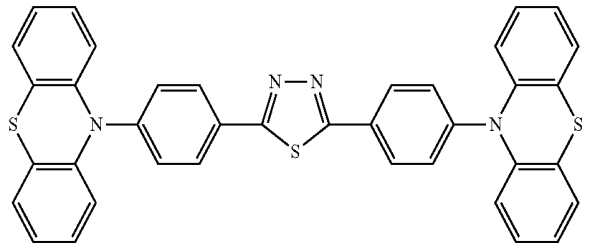

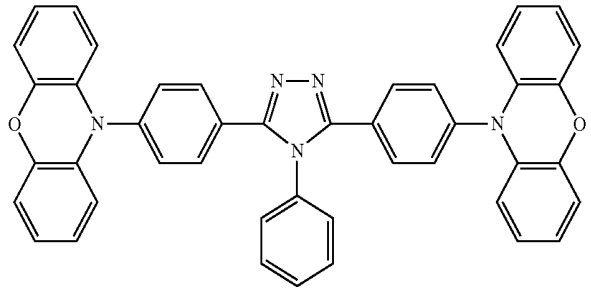

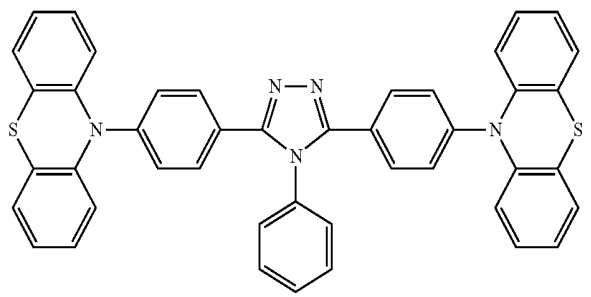

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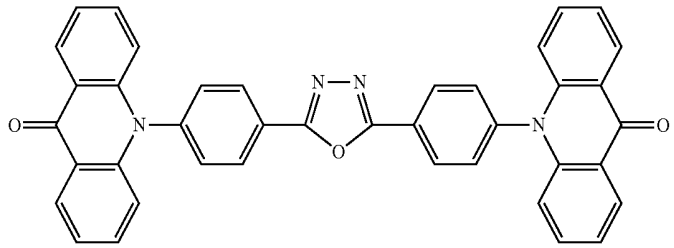

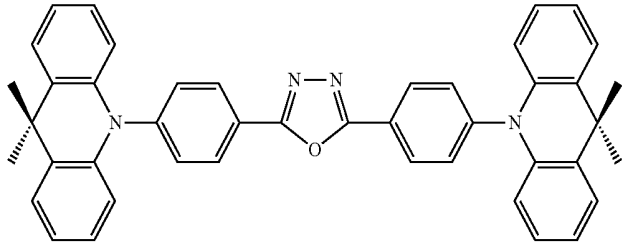

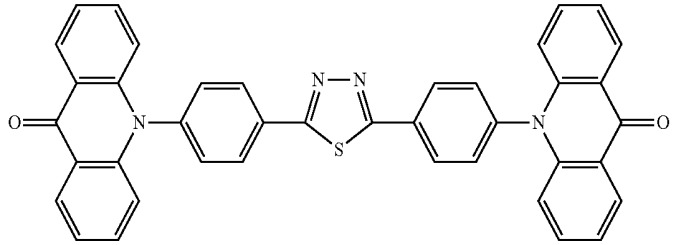

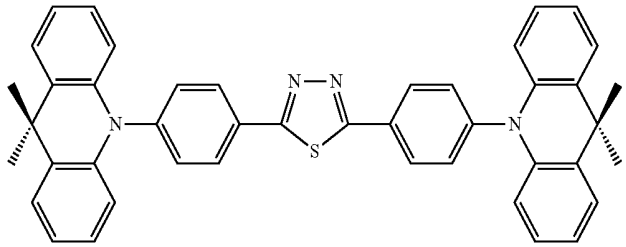

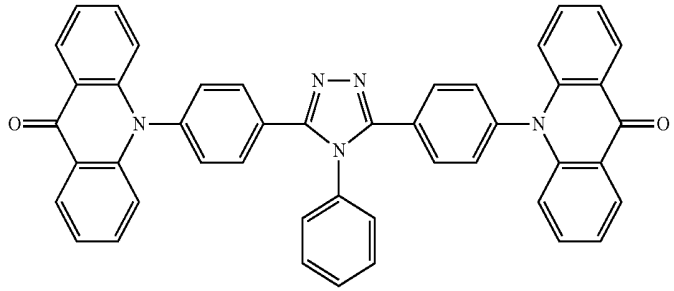

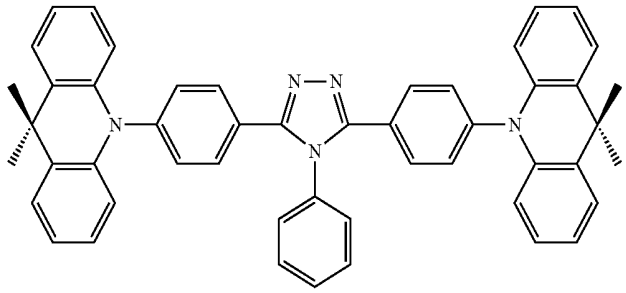

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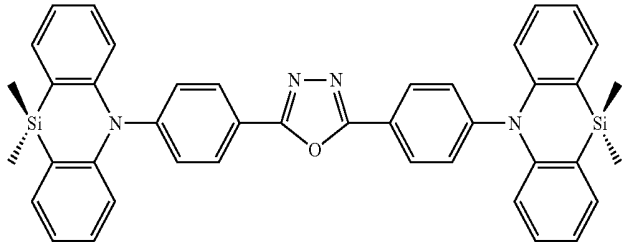

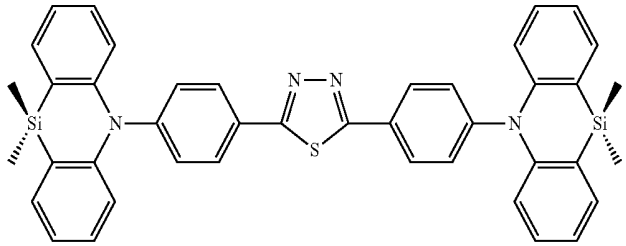

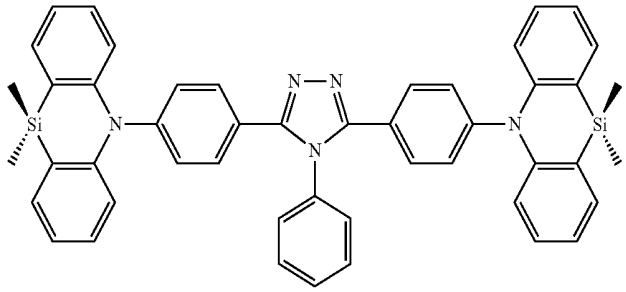

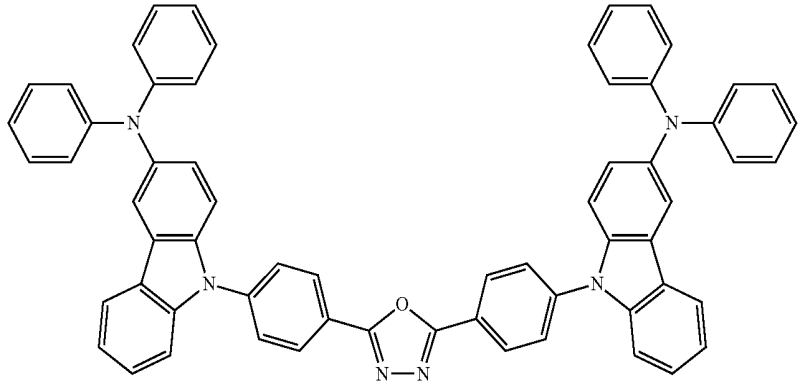

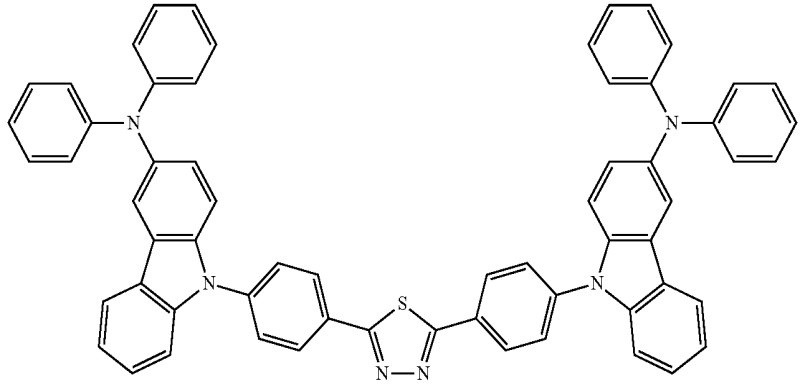

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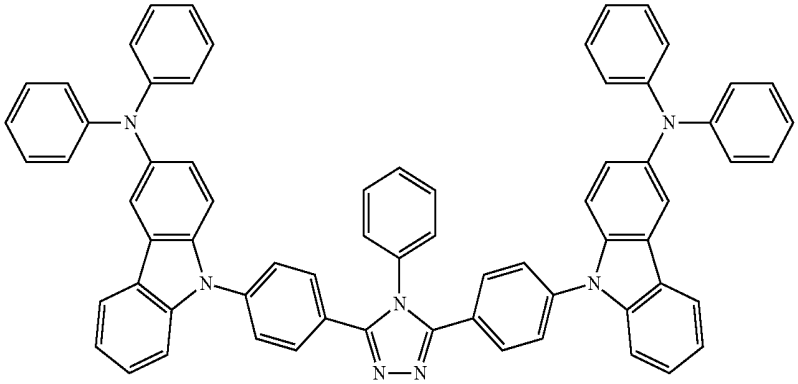

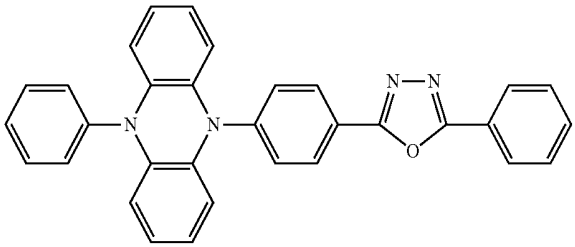

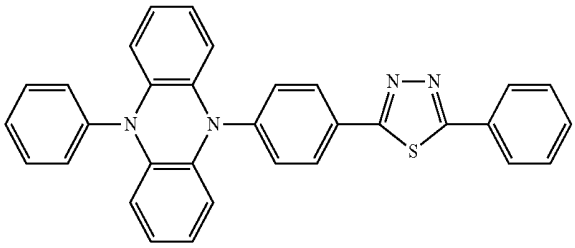

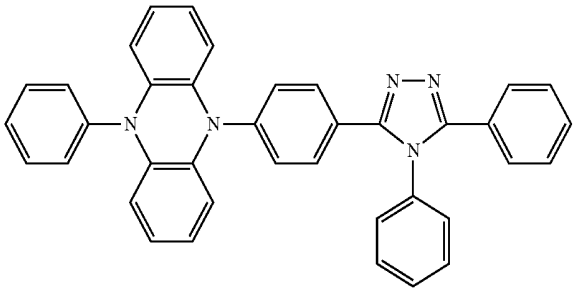

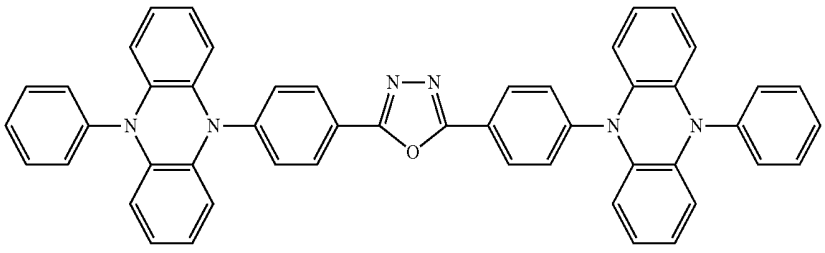

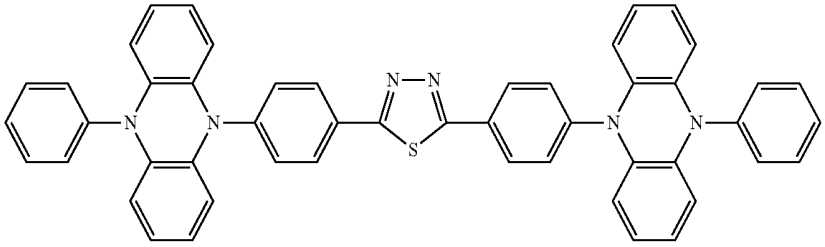

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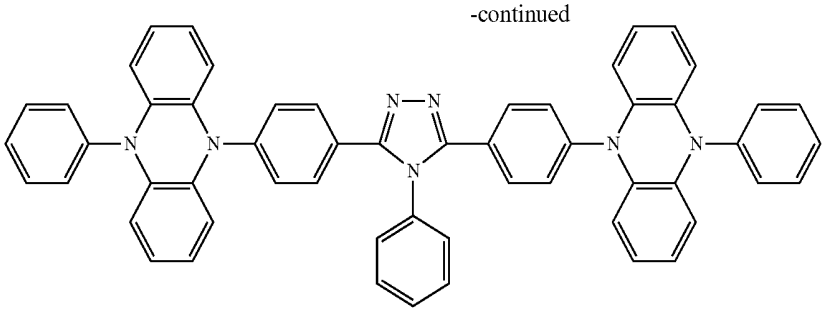


[0226] In the case where the compound represented by the general formula (1) is used as a light-emitting material, on the other hand, one kind or two or more kinds selected from the group of compounds represented by the general formula (1) of the invention may be used therefor. As described above, from the standpoint that the singlet excitons and the triplet excitons generated in the light-emitting material are confined in the light-emitting material, a host material is preferably used in addition to the light-emitting material in the light-emitting layer. The host material used may be are organic compound that has excited singlet energy and excited triplet energy, at least one of which is higher than those of the light-emitting material of the invention. Even though the singlet excitons and the triplet excitons are not confined sufficiently, however, a high light emission efficiency may be obtained in same cases, and thus a host material that is capable of achieving a high light emission efficiency may be used in the invention without any particular limitation.

[0227] In the organic light-emitting device and the organic electroluminescent device of the invention, the light emission occurs in the light-emitting material of the invention contained in the light-emitting layer. The emitted light contains both fluorescent light and delayed fluorescent light. However, a part of the emitted light may contain emitted light from the host material, or the emitted light may partially contain emitted light from the host material.

[0228] In the case where the host material is used, the amount of the compound of the invention as the light-emitting material contained in the light-emitting layer is preferably 0.1% by weight or more, and more preferably 1% by weight or more, and is preferably 50% by weight or less, more preferably 20% by weight or less, and further preferably 10% by weight or less.

[0229] The host material in the light-emitting layer is preferably an organic compound that has a hole transporting function and an electron transporting function, prevents the emitted light from being increased in wavelength, and has a high glass transition temperature.

Injection Layer

[0230] The injection layer is a layer that is provided between the electrode and the organic layer, for decreasing the driving voltage and enhancing the light emission luminance, and includes a hole injection layer and an electron injection layer, which may be provided between the anode and the light-emitting layer or the hole transporting layer and between the cathode and the light-emitting layer or the electron transporting layer. The injection layer may be provided depending on necessity.

Barrier Layer

[0231] The barrier layer is a layer that is capable of inhibiting charges (electrons or holes) and/or excitons present in the light-emitting layer from being diffused outside the light-emitting layer. The electron barrier layer may be disposed between the light-emitting layer and the hole transporting layer, and inhibits electrons from passing through the light-emitting layer toward the hole transporting layer. Similarly, the hole barrier layer may be disposed between the light-emitting layer and the electron transporting layer, and inhibits holes from passing through the light-emitting layer reward the electron transporting layer. The barrier layer may also be used for inhibiting excitons from being diffused outside the light-emitting layer. Thus, the electron barrier layer and the hole barrier layer each may also have a function as an exciton barrier layer. The term "the electron barrier layer" or "the exciton barrier layer" referred herein is intended to include a layer that has both the functions of an electron barrier layer and an exciton barrier layer by one layer.

Hole Barrier Layer

[0232] The hole barrier layer has the function of an electron transporting layer in a broad sense. The hole barrier layer has a function of inhibiting holes from reaching the electron transporting layer while transporting electrons, and thereby enhances the recombination probability of electrons and holes in the light-emitting layer. As the material for the hole barrier layer, the materials for the electron transporting layer described later may be used depending on necessity.

Electron Barrier Layer

[0233] The electron barrier layer has the function of transporting holes in a broad sense. The electron barrier layer has a function of inhibiting electrons from reaching the hole transporting layer while transporting holes, and thereby enhances the recombination probability of electrons and holes in the light-emitting layer.

Exciton Barrier Layer

[0234] The exciton barrier layer is a layer for inhibiting excitons generated through recombination of holes and electrons in the light-emitting layer from being diffused to the charge transporting layer, and the use of the layer inserted enables effective confinement of excitons in the light-emitting layer, and thereby enhances the light emission efficiency of the device. The exciton barrier layer may be inserted adjacent to the light-emitting layer on any of the

side of the anode and the side of the cathode, and on both the sides. Specifically, in the case where the exciton barrier layer is present on the side of the anode, the layer may be inserted between the hole transporting layer and the light-emitting layer and adjacent to the light-emitting layer, and in the case where the layer is inserted on the side of the cathode, the layer may be inserted between the light-emitting layer and the cathode and adjacent to the light-emitting layer. Between the anode and the exciton barrier layer that is adjacent to the light-emitting layer on the side of the anode, a hole injection layer, an electron barrier layer and the like may be provided, and between the cathode and the exciton barrier layer that is adjacent to the light-emitting layer on the side of the cathode, an electron injection layer, an electron transporting layer, a hole harrier layer and the like may be provided. In the case where the barrier layer is provided, the material used for the barrier layer preferably has excited singlet energy and excited triplet energy, at least one of which is higher than the excited singlet energy and the excited triplet energy of the light-emitting layer, respectively.

Hole Transporting Layer

[0235] The hole transporting layer is formed of a hole transporting material having a function of transporting holes, and the hole transporting layer may be provided as a single layer or plural layers.

[0236] The hole transporting material has one of injection or transporting properly of holes and barrier property of electrons, and may be any of an organic material and an inorganic material. Examples of known hole transporting materials that may be used herein include a triazole derivative, an oxadiazole derivative, an imidazole derivative, a carbazole derivative, an indolocarbazole derivative, a polyarylalkane derivative, a pyrazoline derivative, a pyrazolone derivative, a phenylenediamine derivative, an arylamine derivative, an amino-substituted chalcone derivative, an oxazole derivative, a styrylanthracene derivative, a fluorenone derivative, a hydrazone derivative, a stilbene derivative, a silazane derivative, an aniline copolymer and an electroconductive polymer oligomer, particularly a thiophene oligomer. Among these, a porphyrin compound, an aromatic tertiary amine compound and a styrylamine compound are preferably used, and an aromatic tertiary amine compound is more preferably used.

Electron Transporting Layer

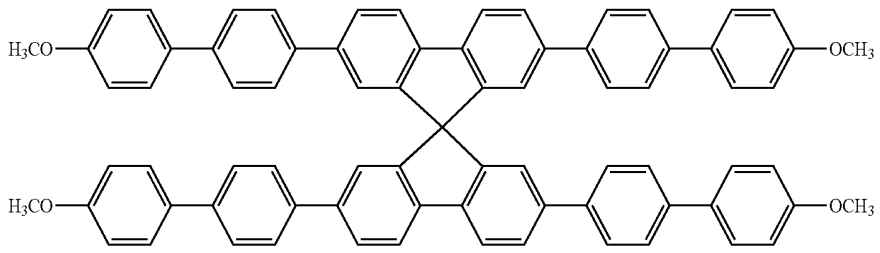
[0237] The electron transporting layer is formed of a material having a function of transporting electrons, and the electron transporting layer may be provided as a single layer or plural layers.

[0238] The electron transporting material (which may also function as a hole barrier material in some cases) needs only to have a function of transporting electrons, which are injected from the cathode, to the light-emitting layer. Examples of the electron transporting layer that may be used herein include a nitro-substituted fluorene derivative, a diphenylquinone derivative, a thiopyran dioxide derivative, carbodiimide, a fluorenylidene methane derivative, anthraquinodimethane and anthrone derivatives, and an oxadiazole derivative. The electron transporting material used may be a thiadiazole derivative obtained by replacing the oxygen atom of the oxadiazole rang of the oxadiazole derivative by a sulfur atom, or a quinoxaline derivative having a quinoxaline ring, which is known as an electron withdrawing group. Furthermore, polymer materials having these materials introduced to the polymer chain or having these materials used as the main chain of the polymer may also be used.

[0239] In the production of the organic electroluminescent device, the compound represented by the general formula (1) may be used not only in the light-emitting layer but also in the other layers than the light-emitting layer. In this case, the compound represented by the general formula (1) used in the light-emitting layer and the compound represented by the general formula (1) used in the other layers than the light-emitting layer may be the same as or different from each other. For example, the compound represented by the general formula (1) may be used in the injection layer, the barrier layer, the hole barrier layer, the electron barrier layer, the exciton barrier layer, the hole transporting layer, the electron transporting layer and the like described above. The film forming method of the layers are not particularly limited, and the layers may be produced by any of a dry process and a wet process.

[0240] Specific examples of preferred materials that may be used in the organic electroluminescent device are shown below, but the materials that may be used in the invention are not construed as being limited to the example compounds. The compound that is shown as a material having a particular function may also be used as a material having another function. In the structural formulae of the example compounds, R and R_6 to R_7 each independently represent a hydrogen atom or a substituent, and n represents an integer of from 3 to 5.

[0241] In the case where the compound represented by the general formula (1) is used as a light-emitting material, preferred examples of a compound that may also be used as the host material of the light-emitting layer are shown below.



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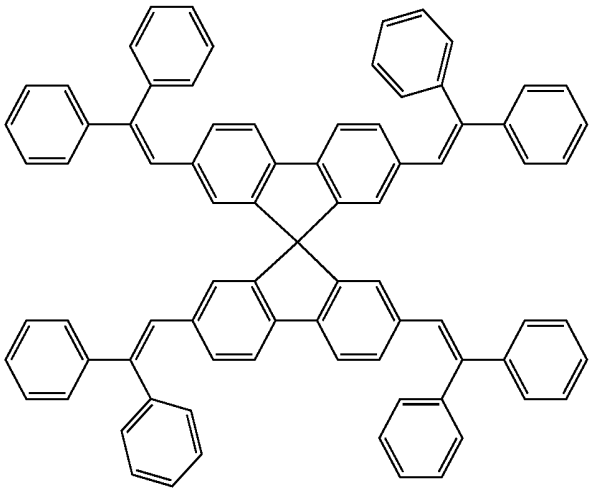

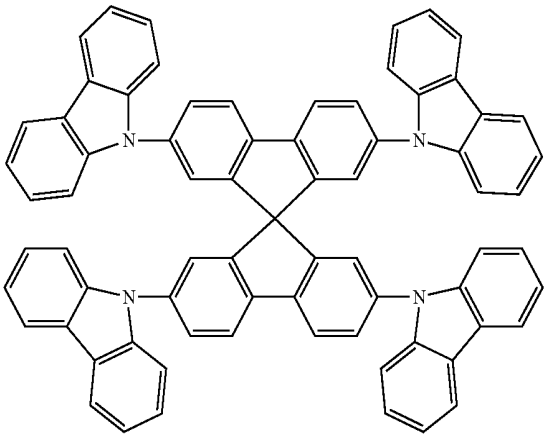

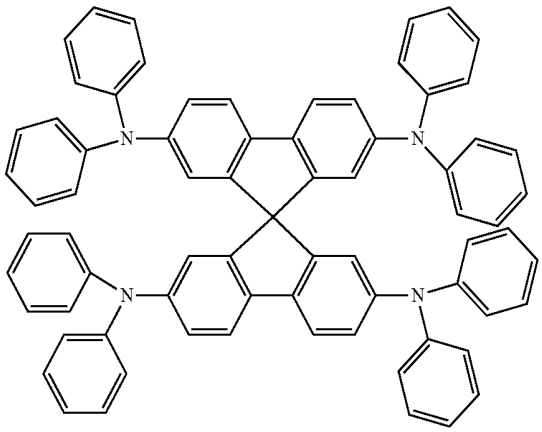

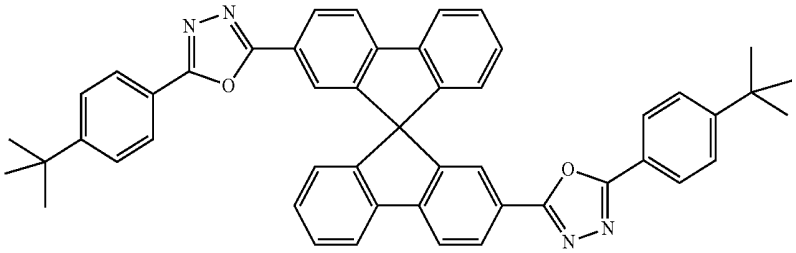

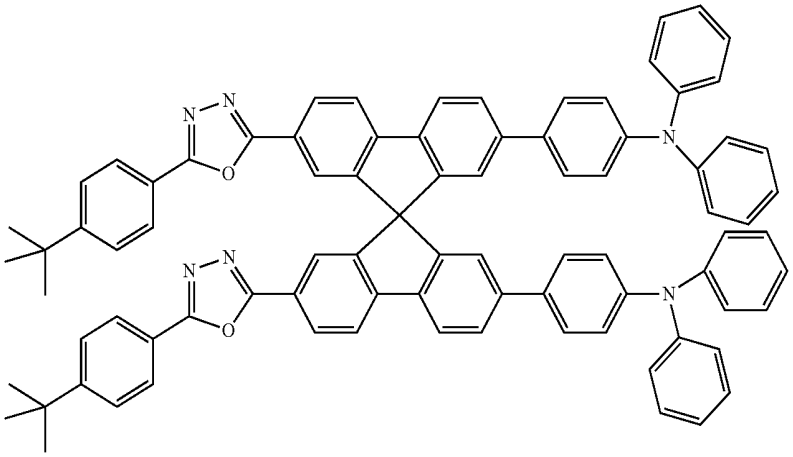

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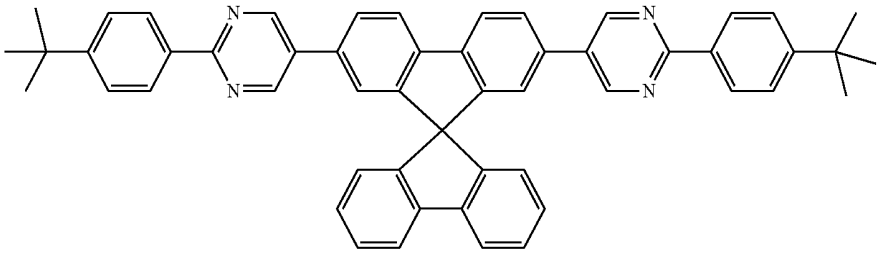

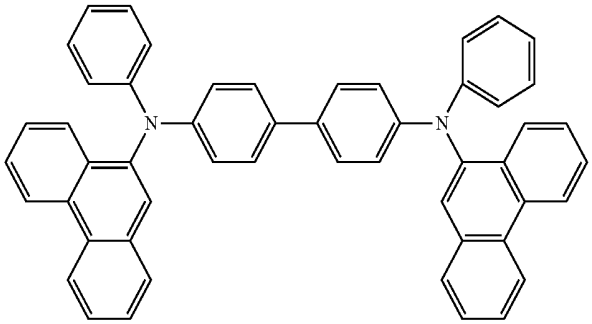

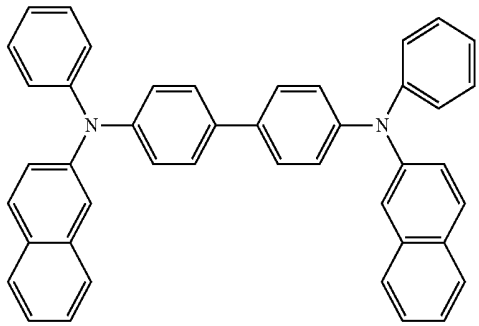

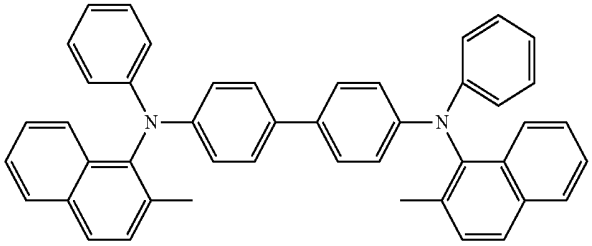

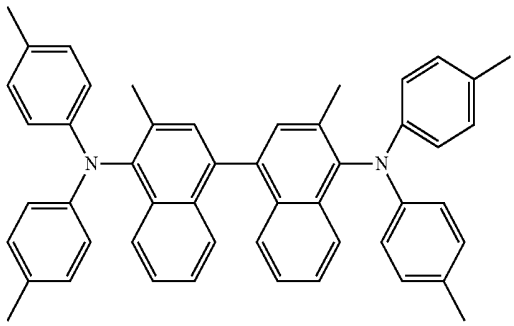

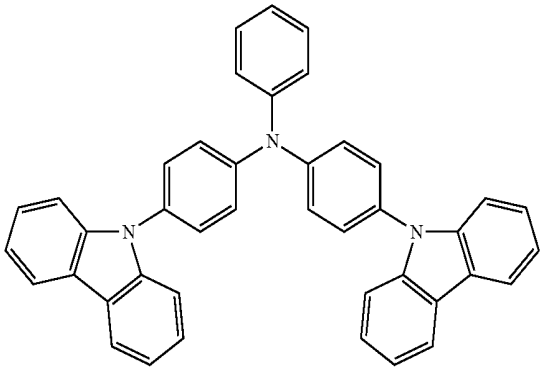

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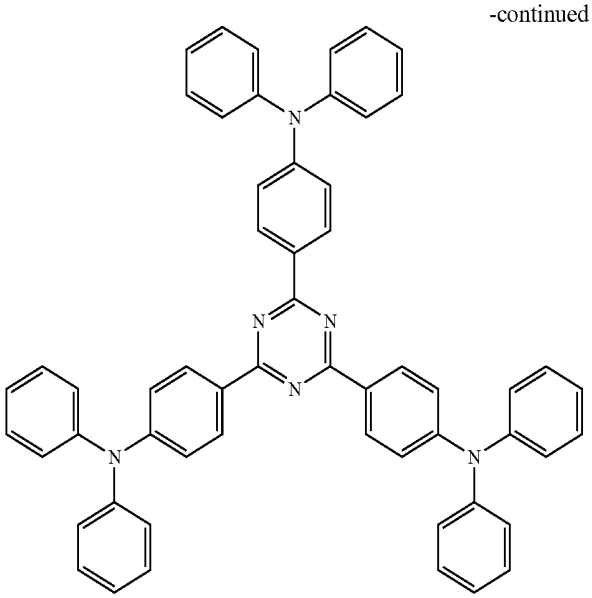

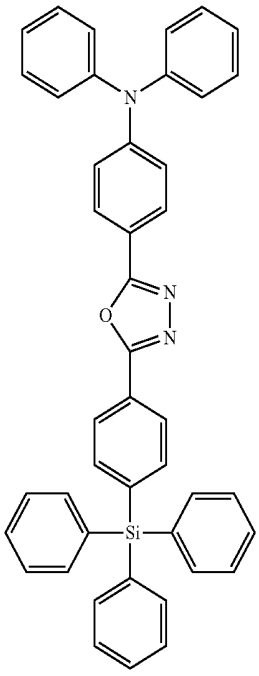

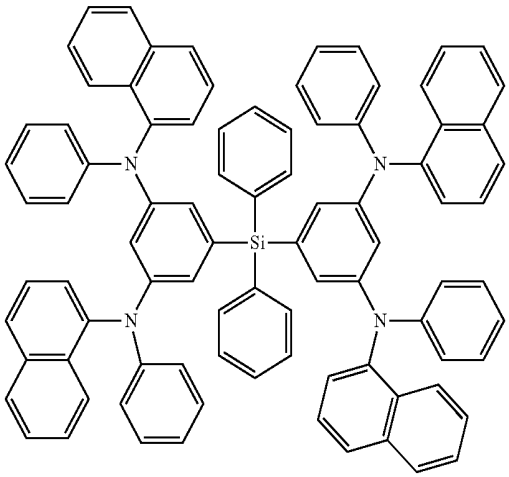

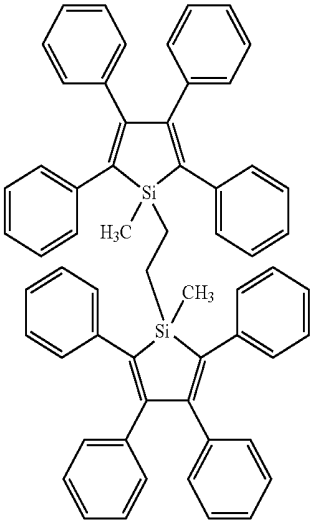

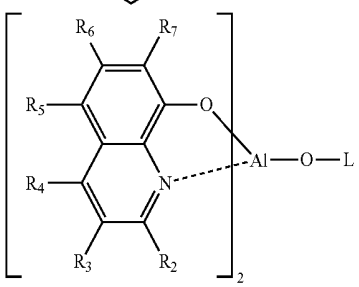

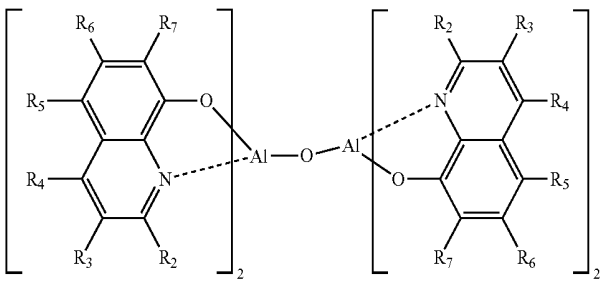

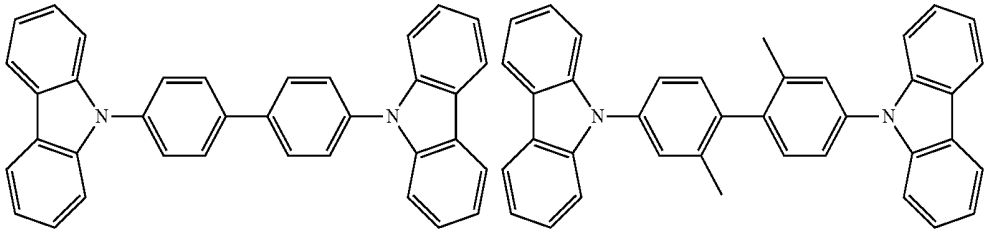

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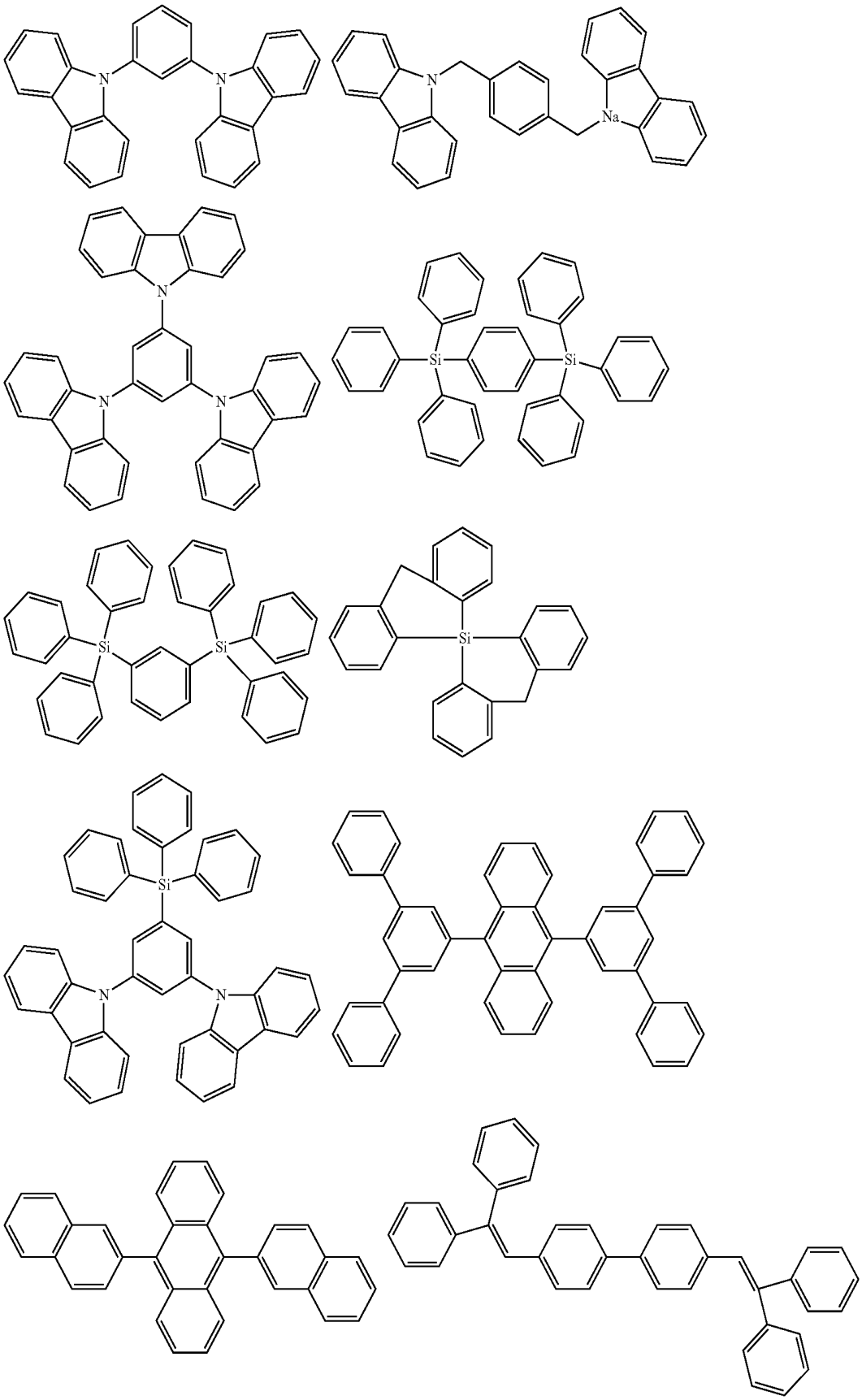

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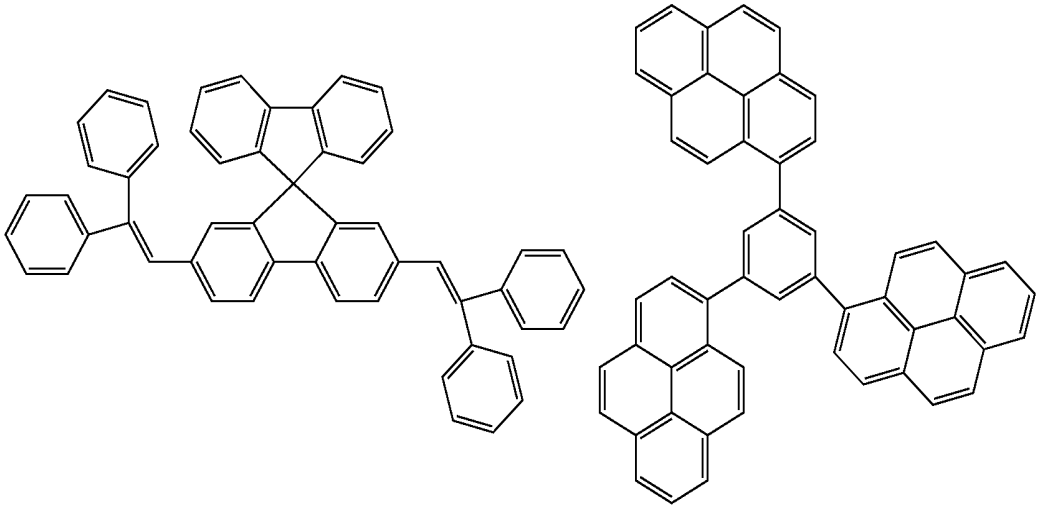

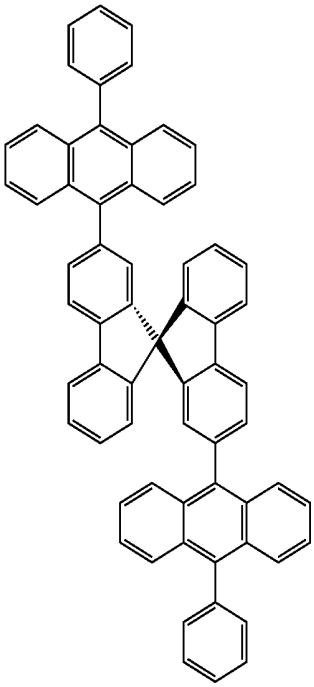

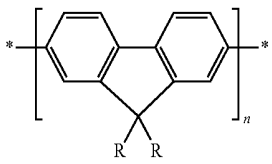

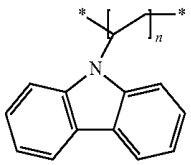

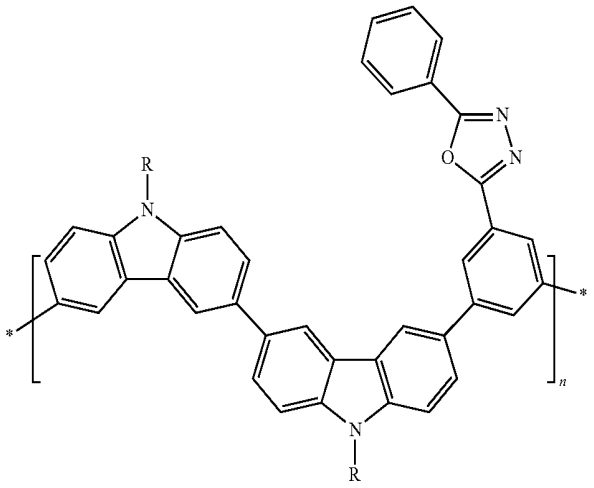

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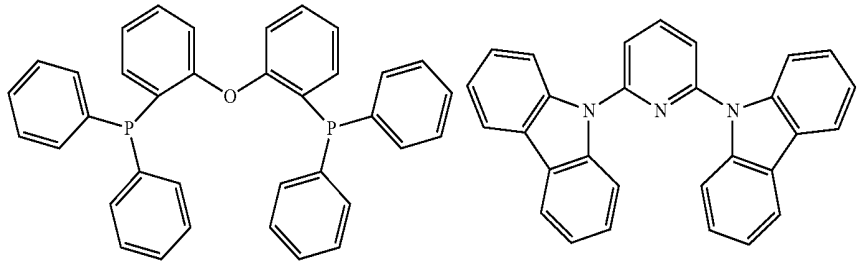
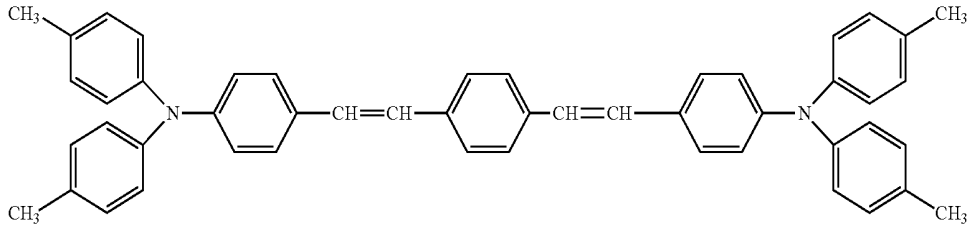
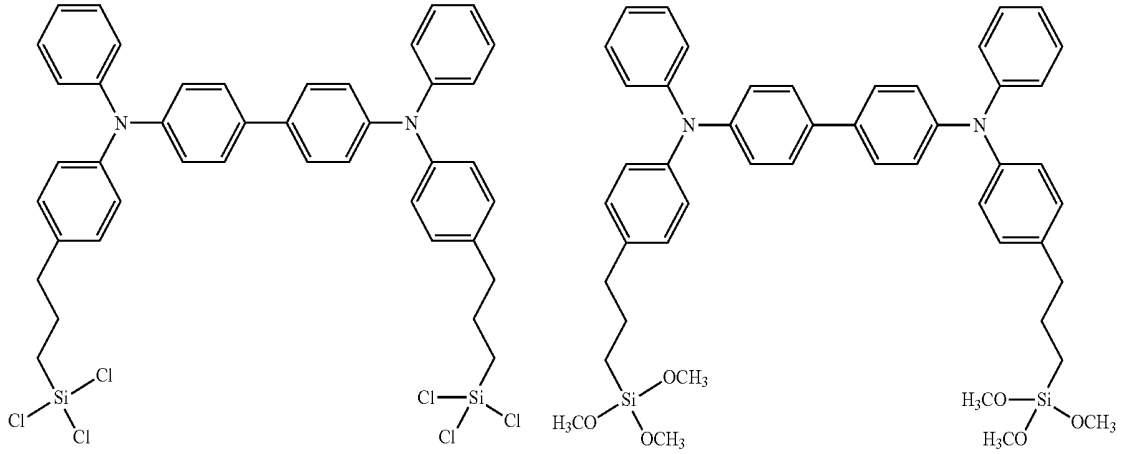
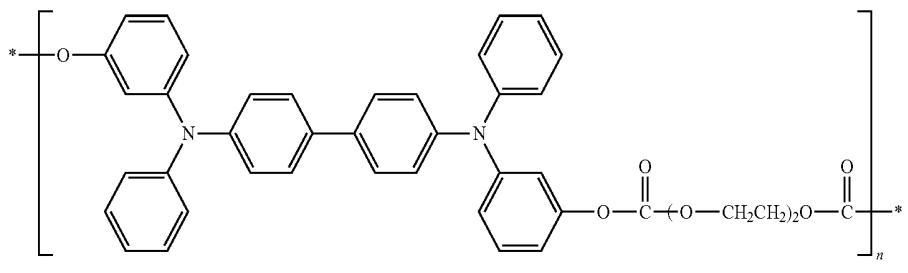




[0242] Preferred examples of a compound that may be used as the hole injection material are shown below.





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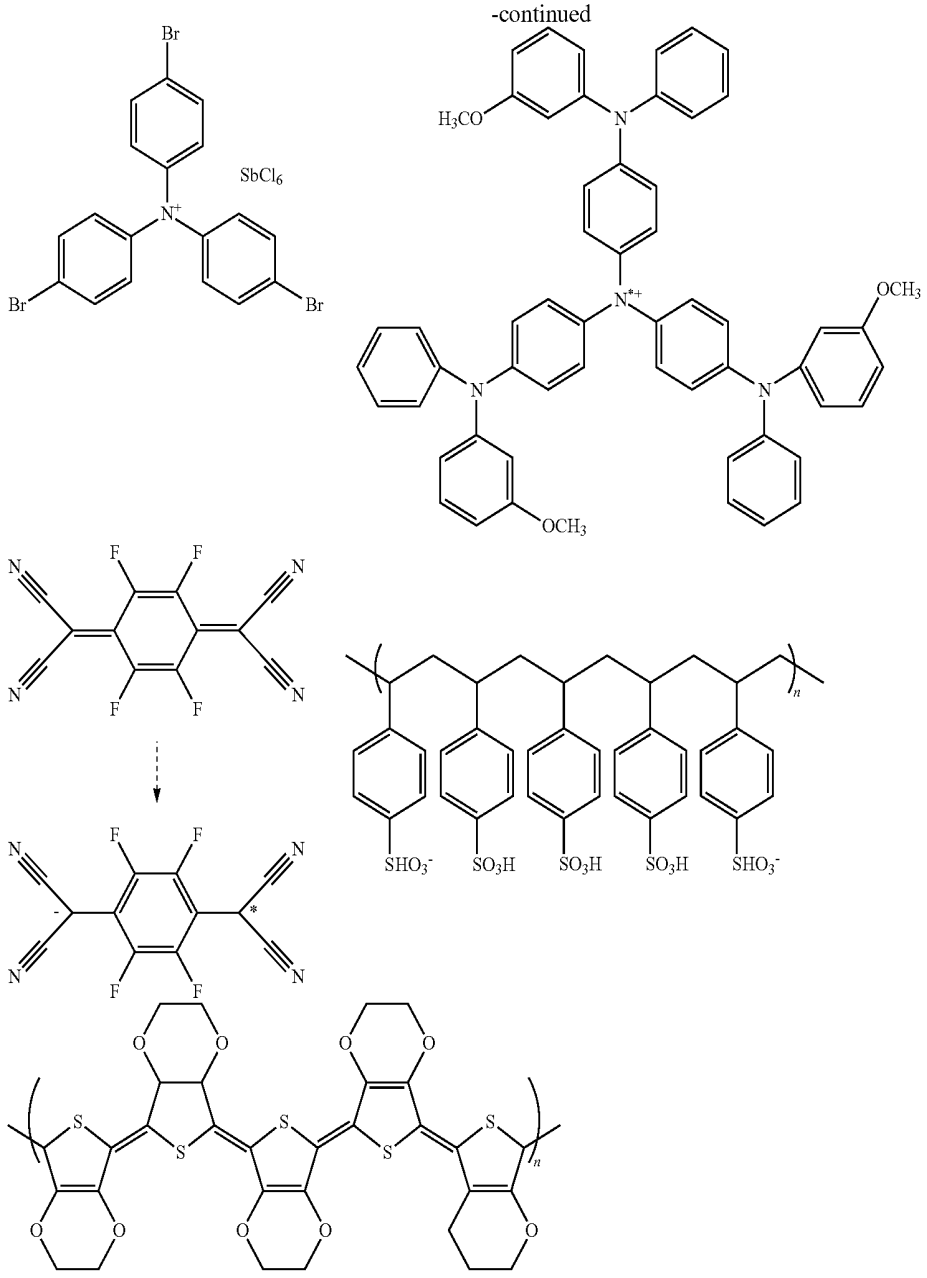
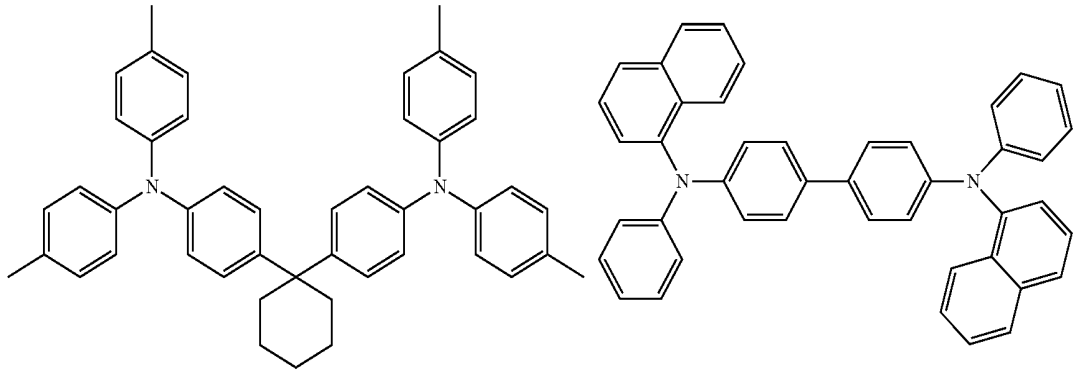


[0243] Preferred examples of a compound that may be used as the hole transporting material are shown below.



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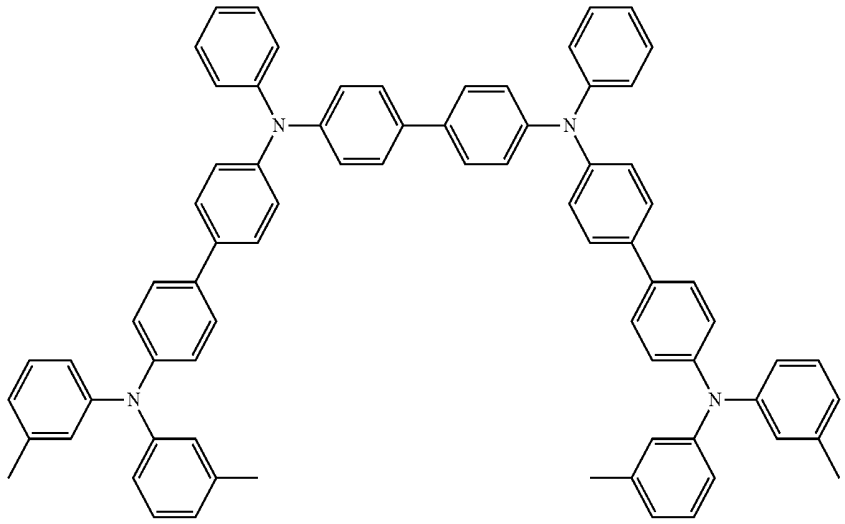

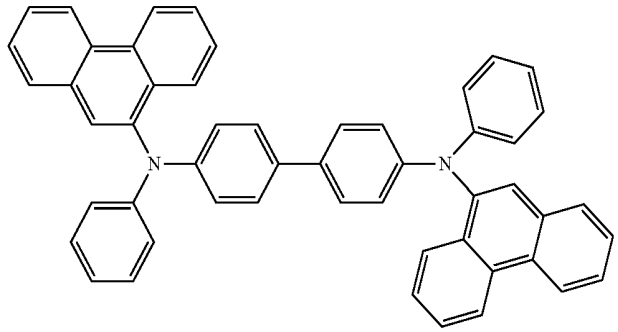

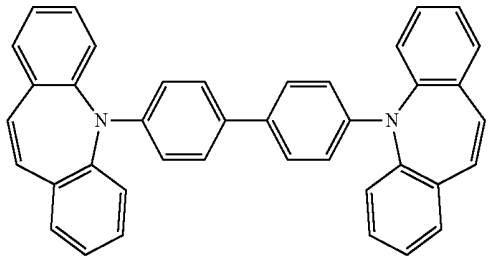

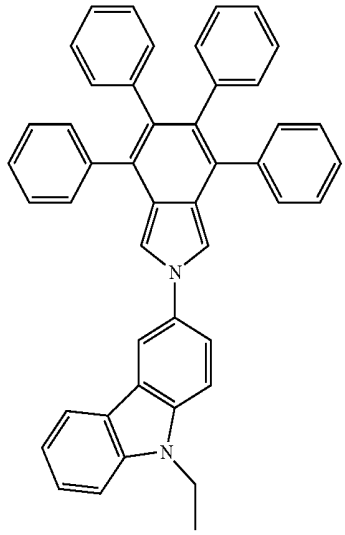

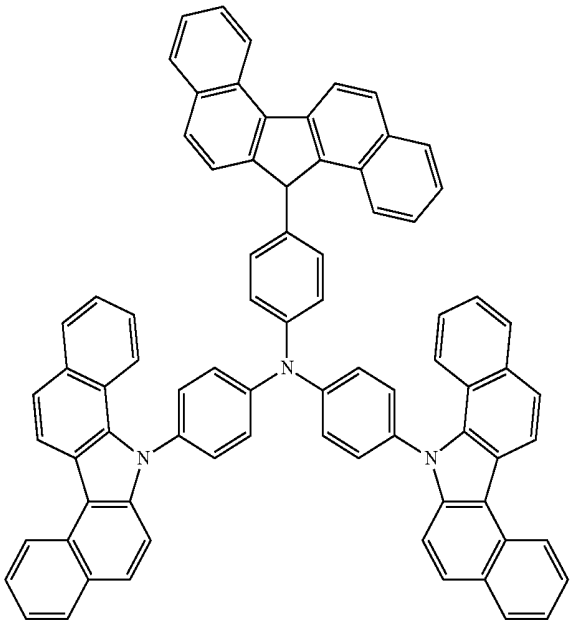

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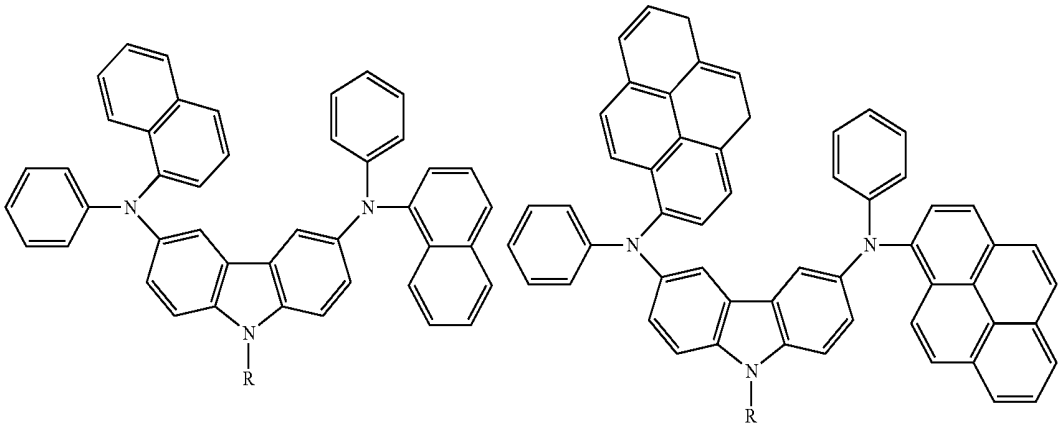

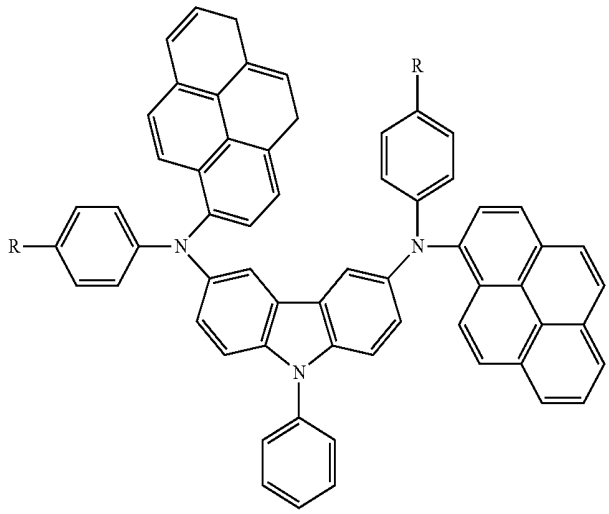

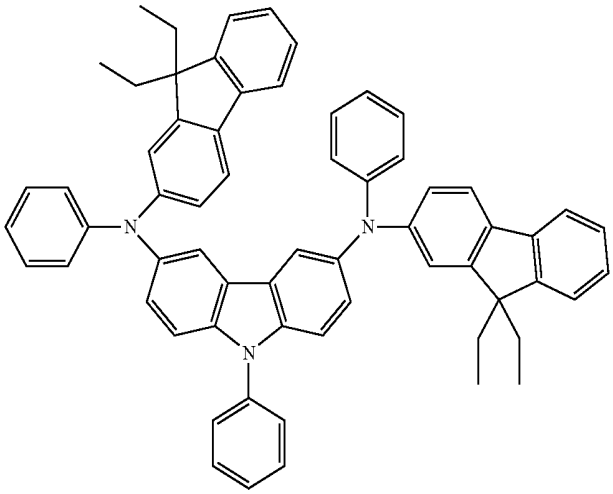

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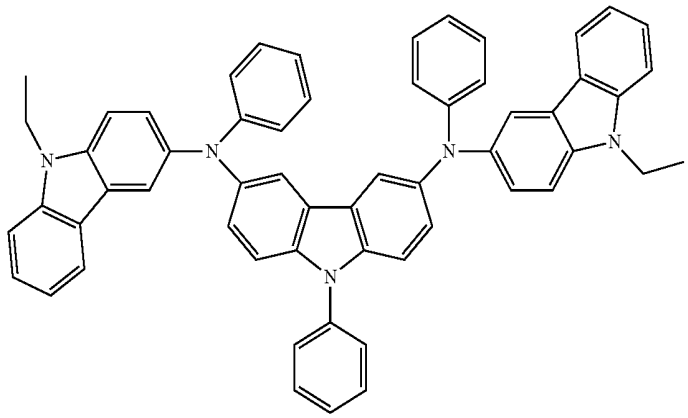

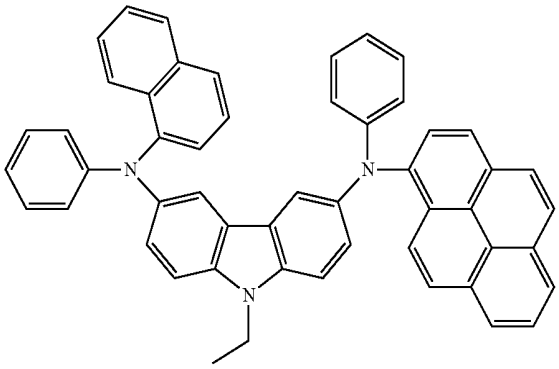

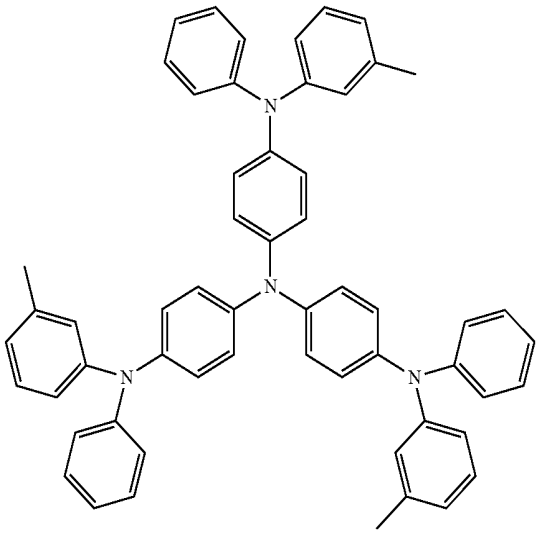

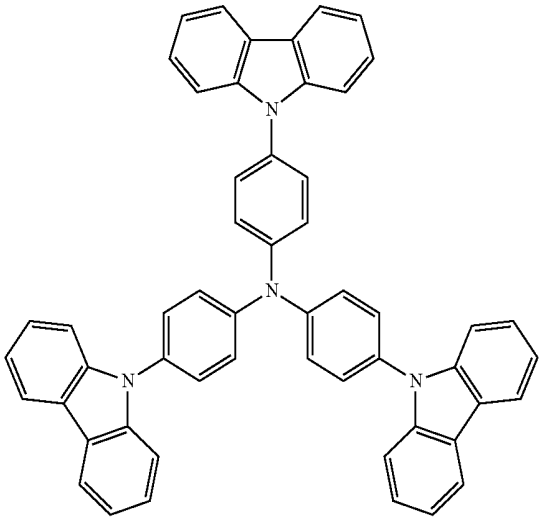

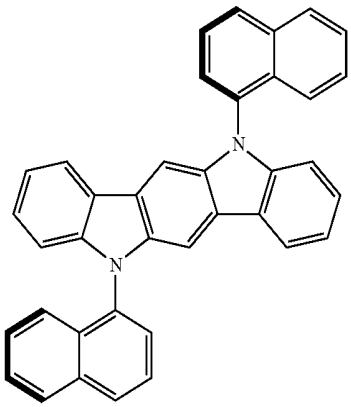

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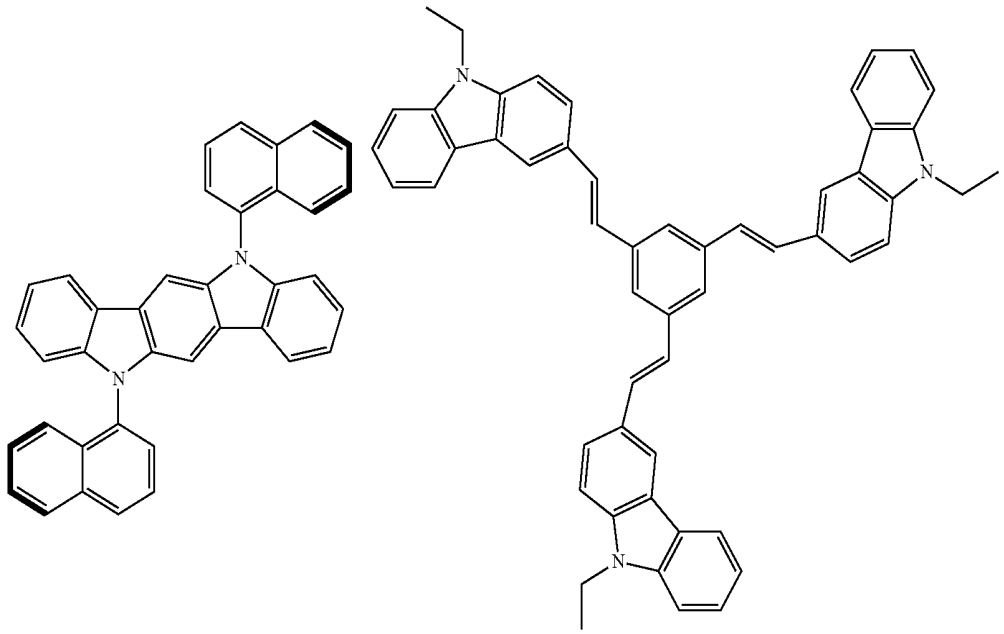

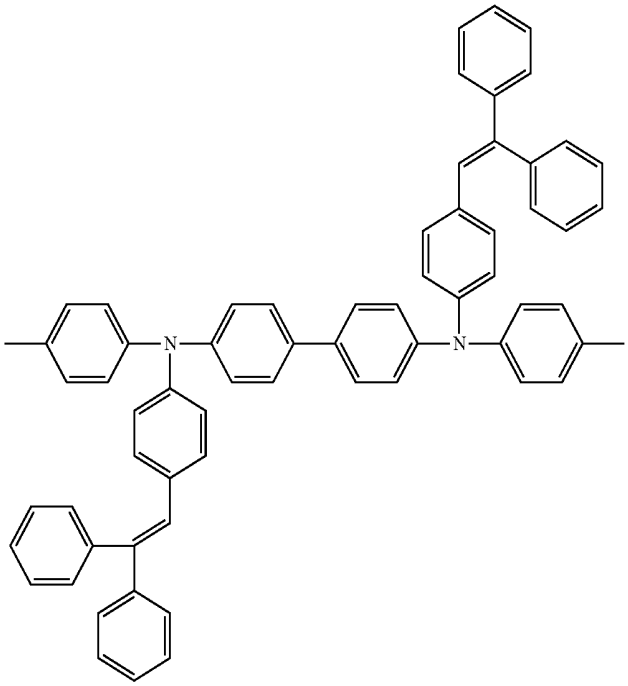

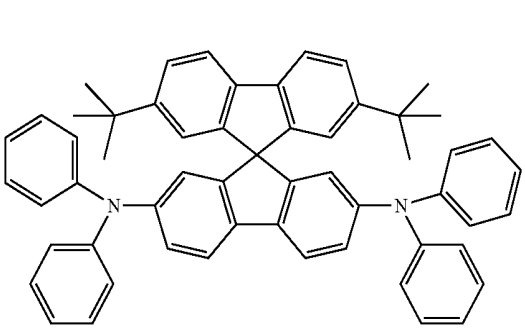

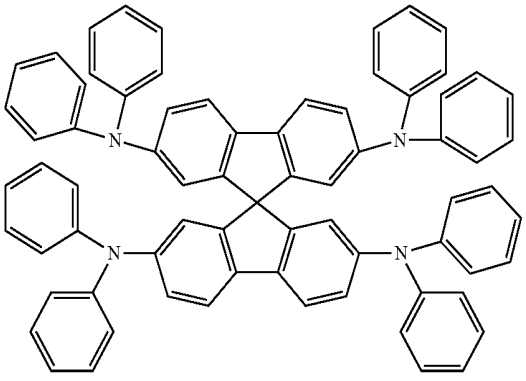

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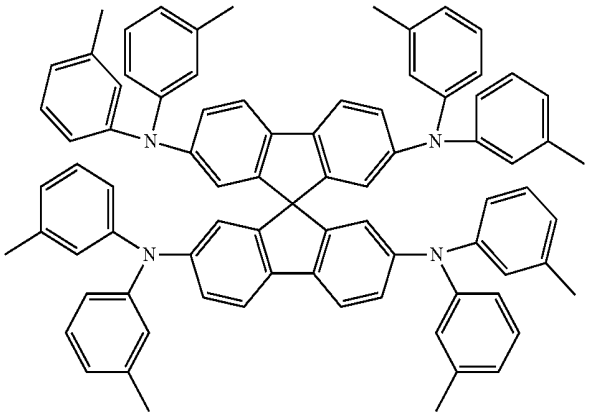

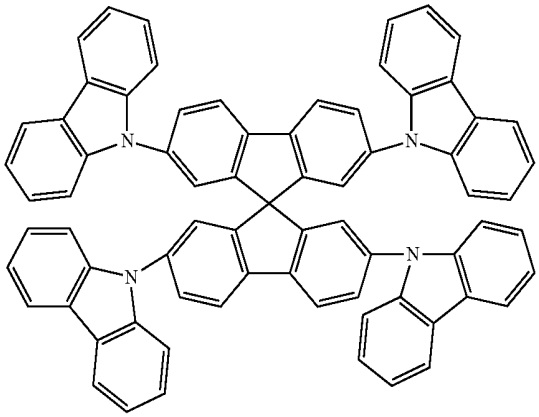

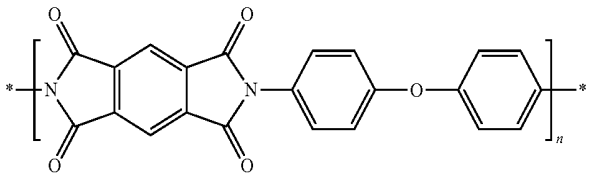

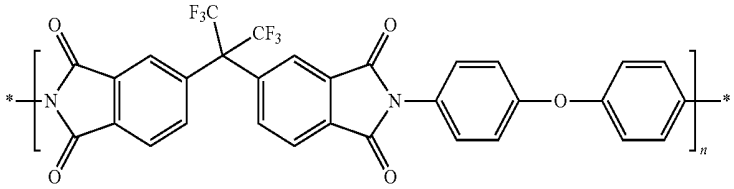

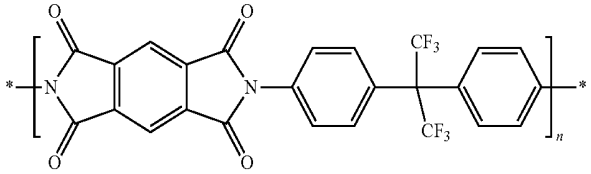

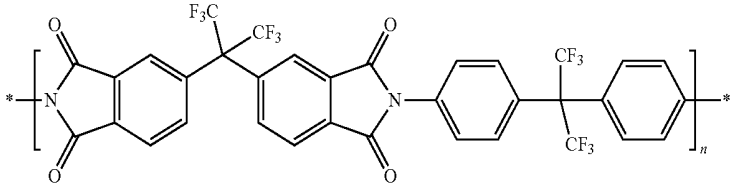

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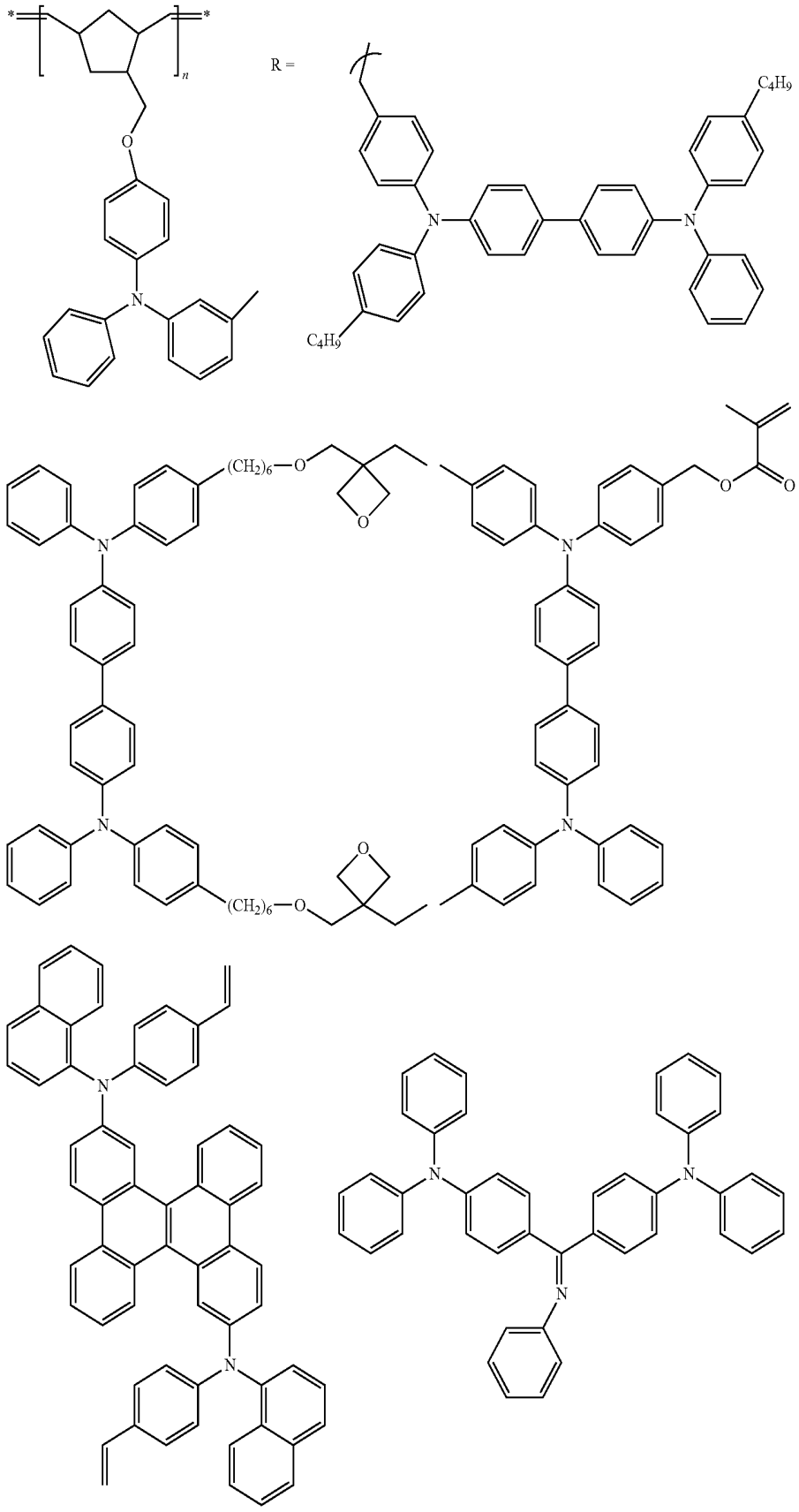

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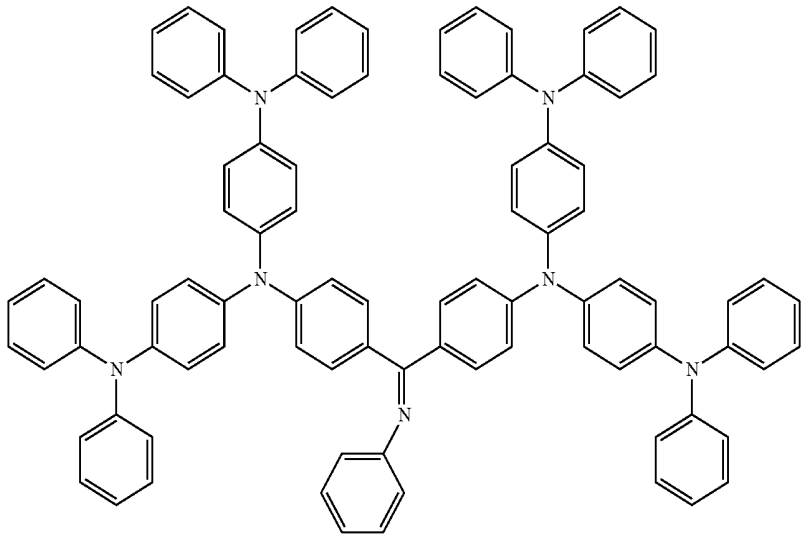

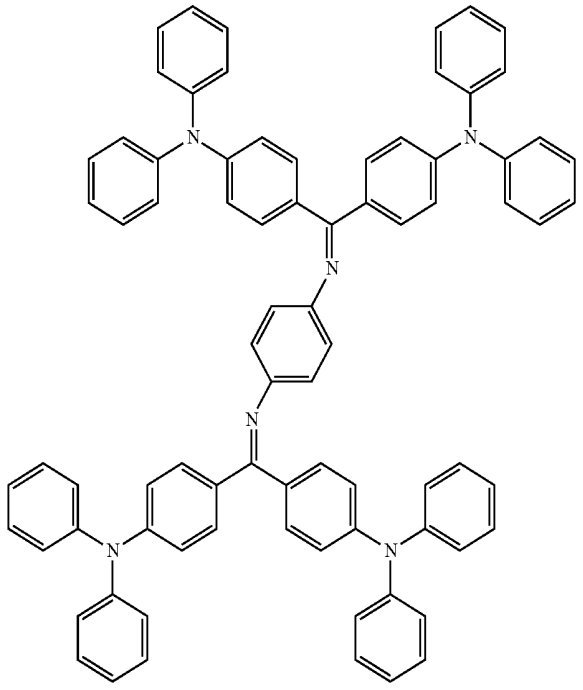

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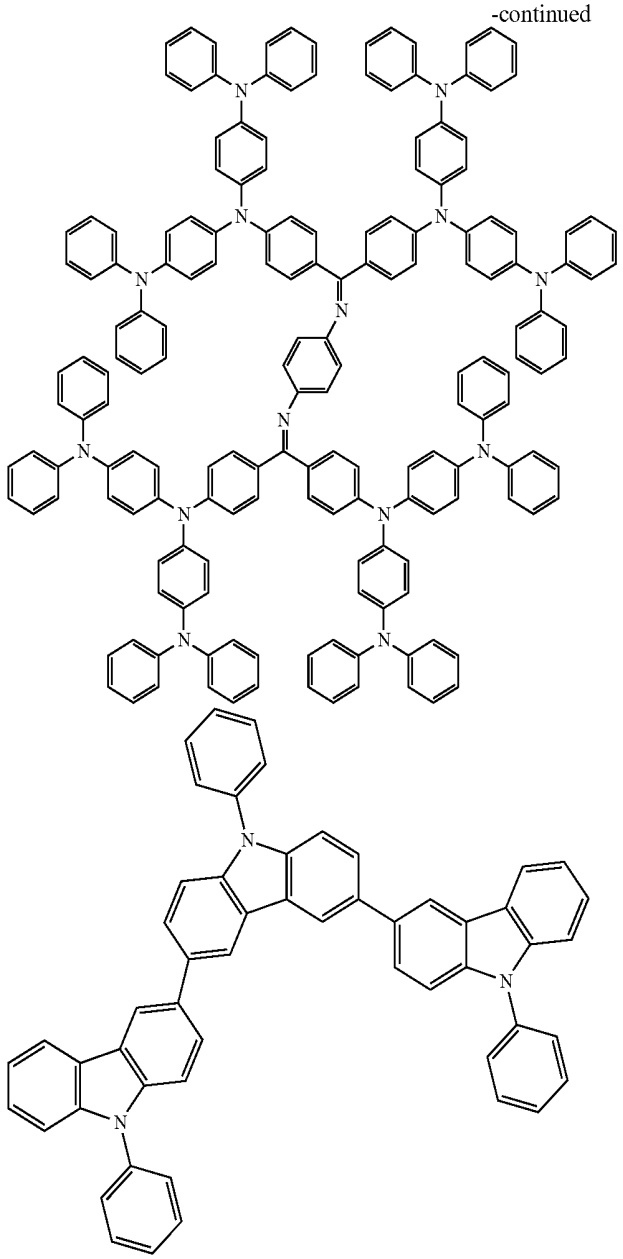

[0244] Preferred examples of a compound that may be used as the electron barrier material are shown below.

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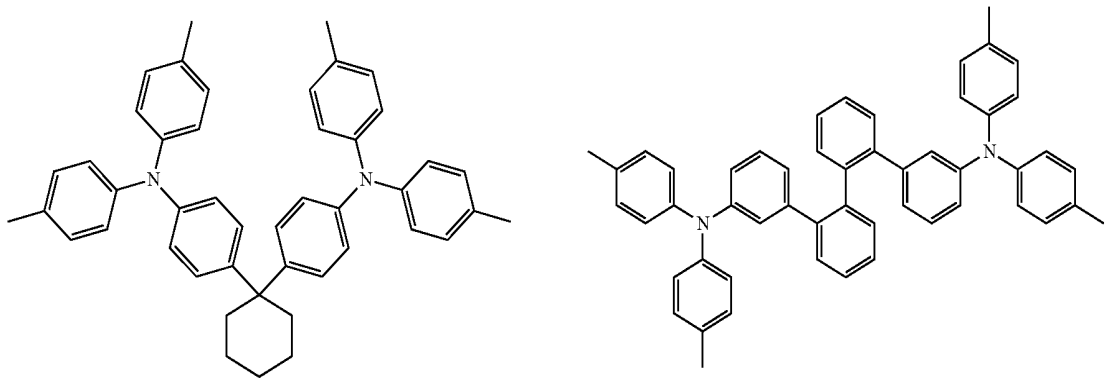

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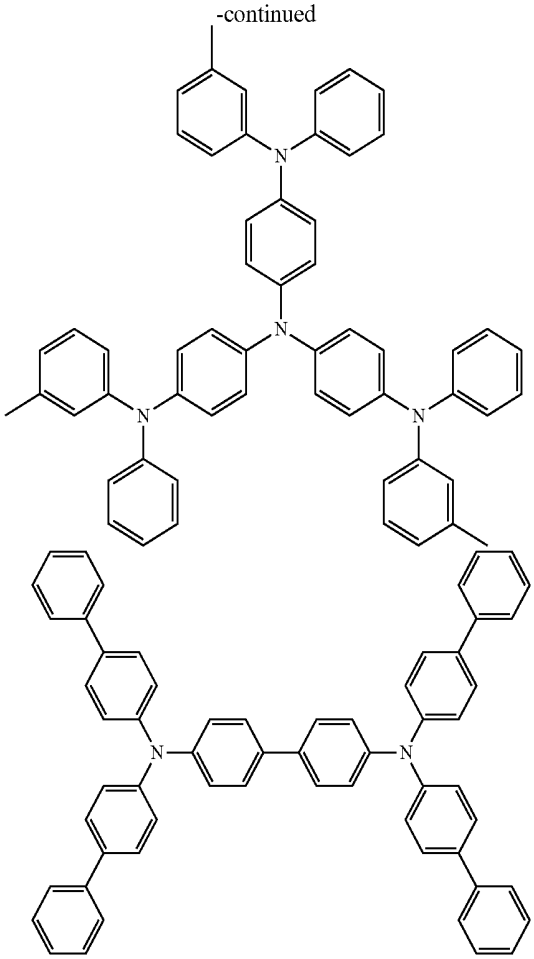

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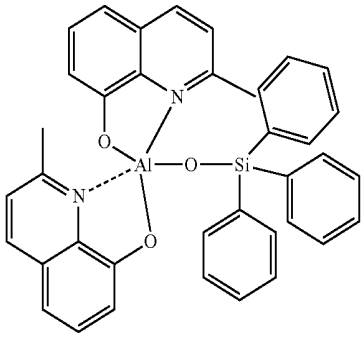
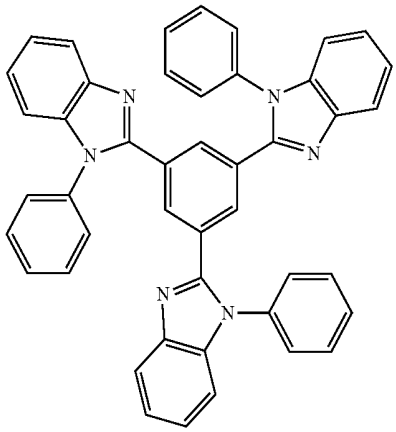
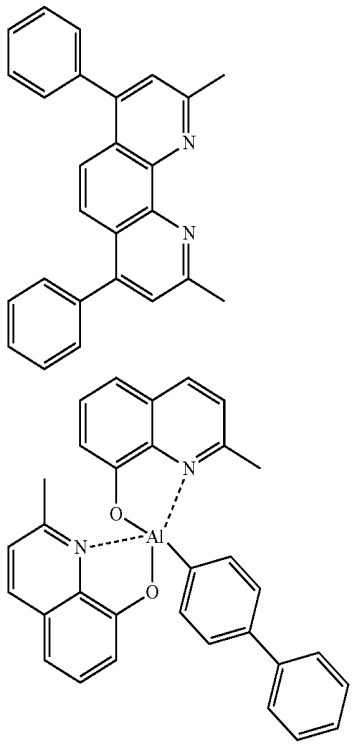
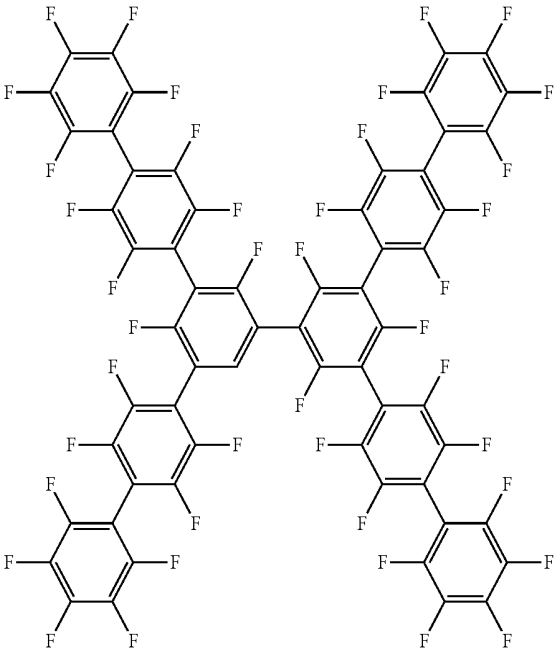




[0245] Preferred examples of a compound that may be used as the hole barrier material are shown below.





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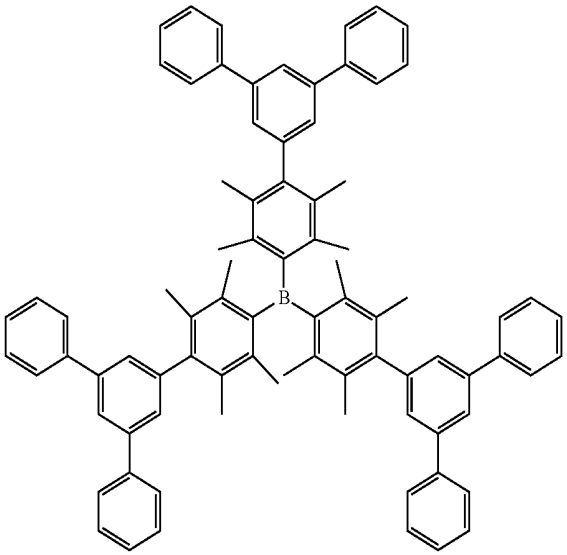

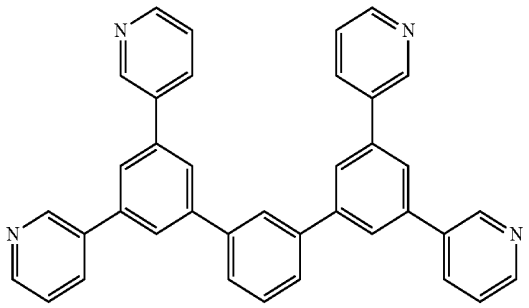

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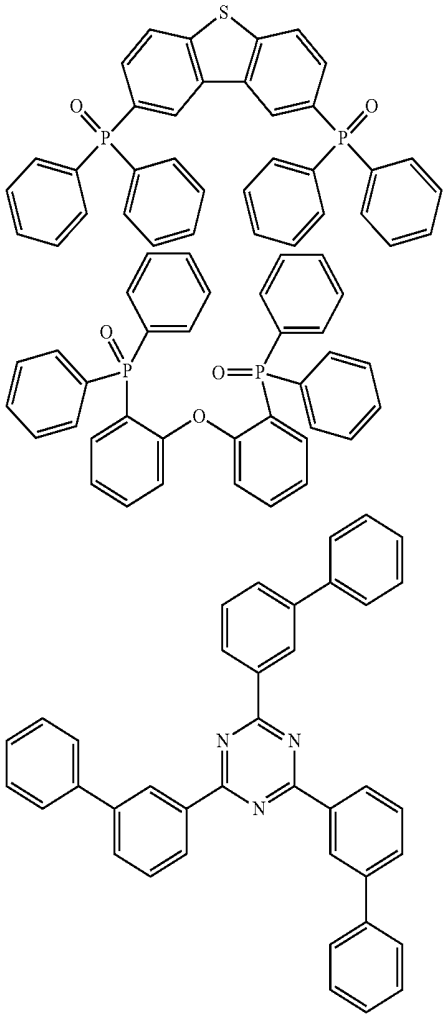
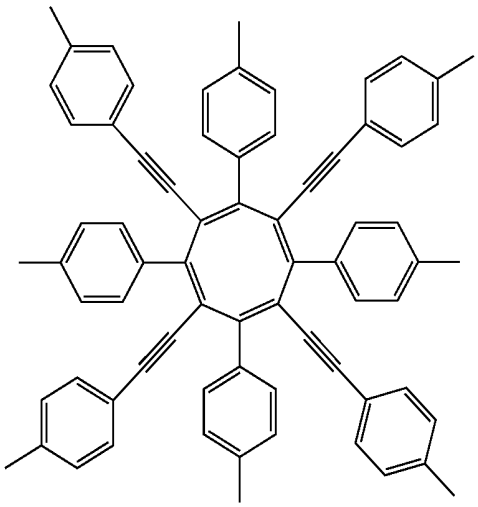
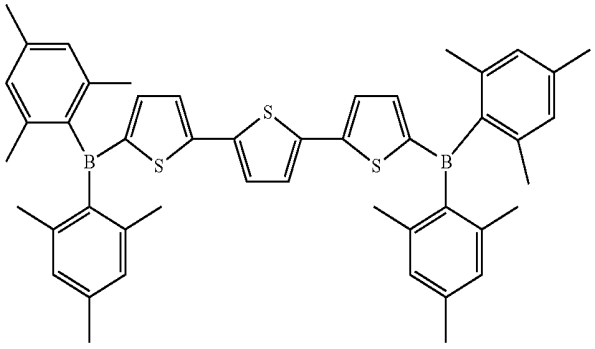


[0246] Preferred examples of a compound that may be used as the electron transporting material are shown below.





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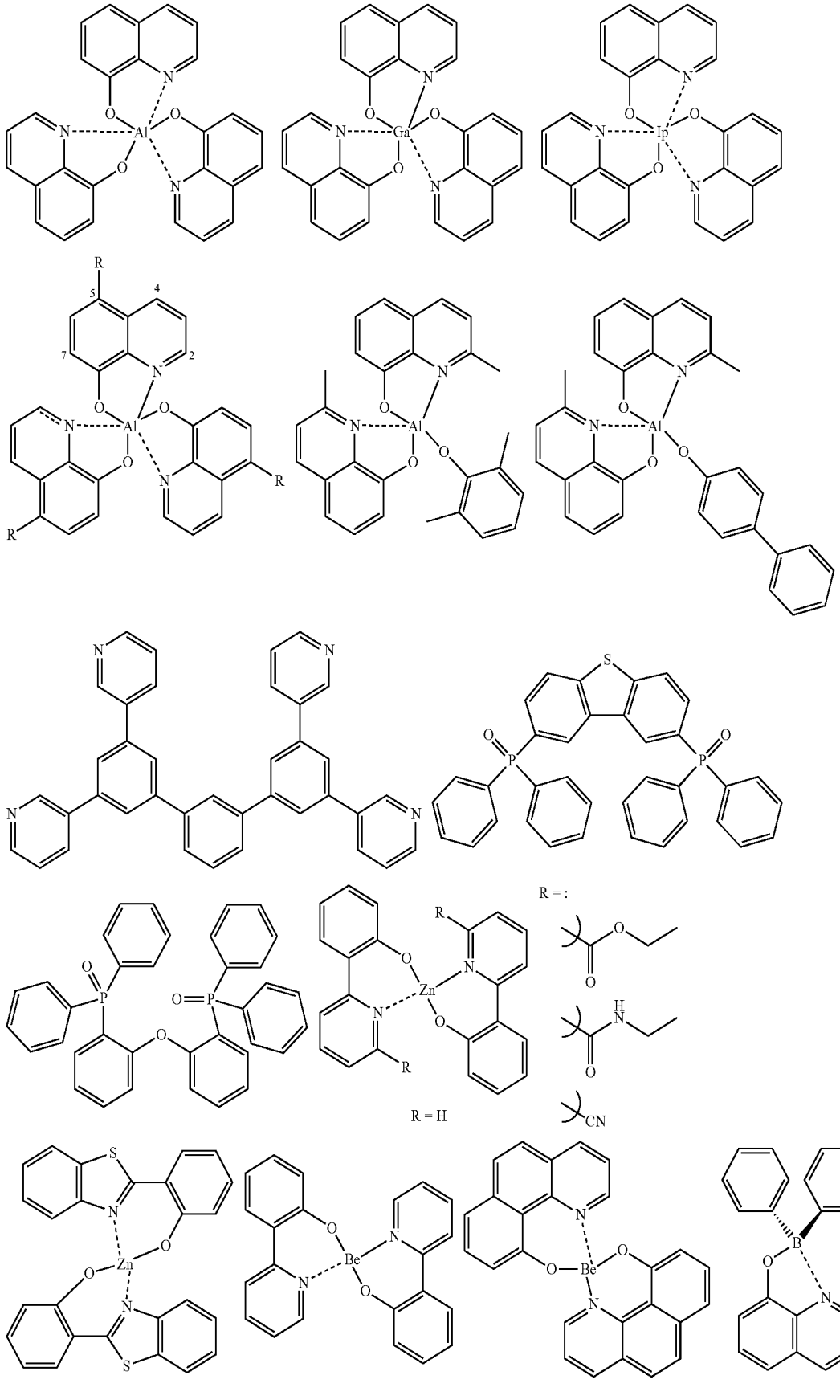

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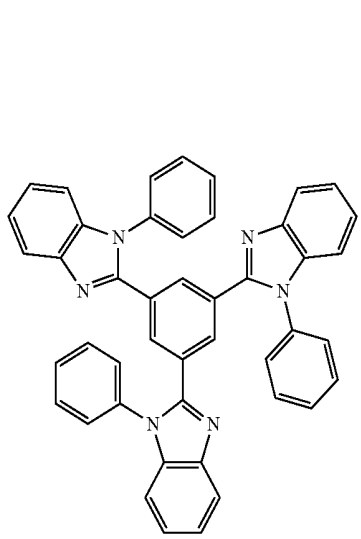

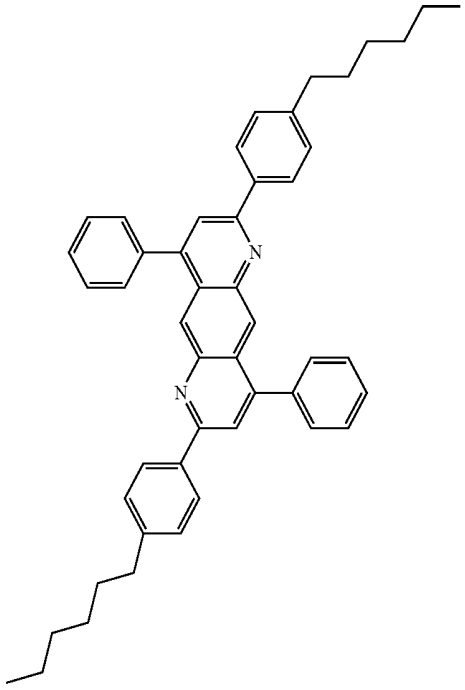

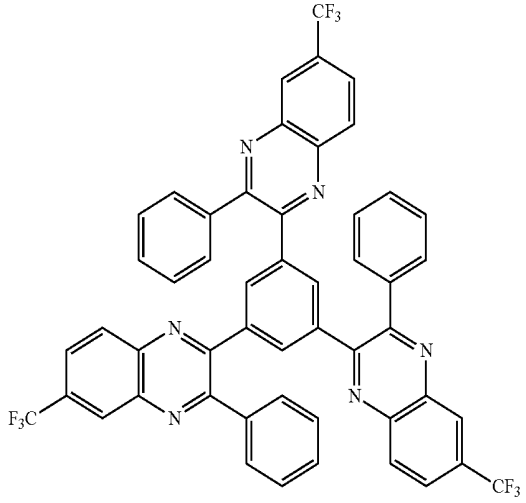

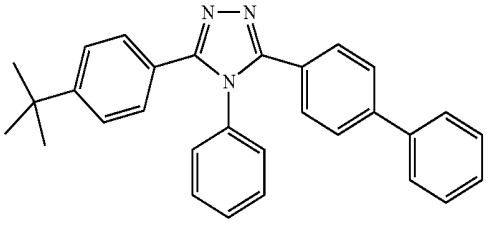

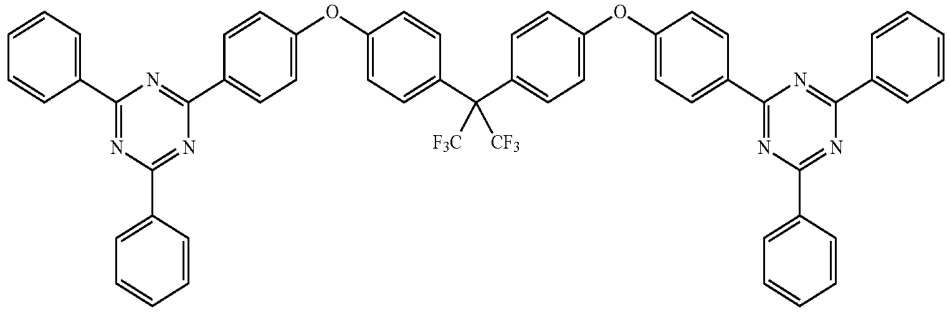

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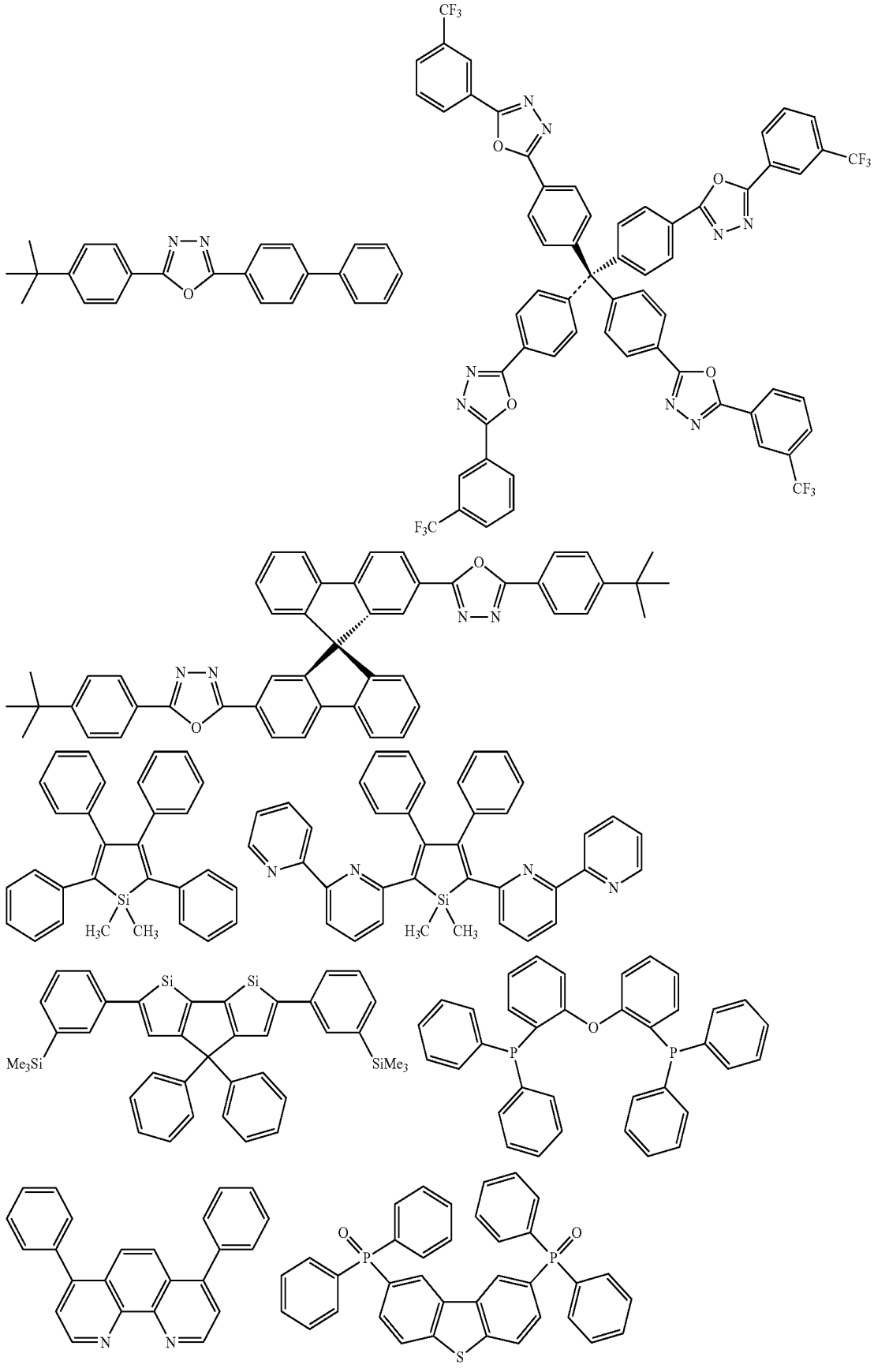
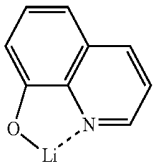
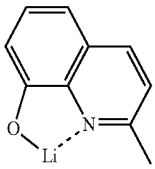
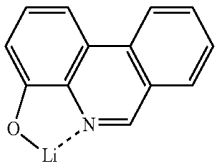
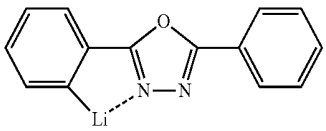


[0247] Preferred examples of a compound that may be used as the electron inaction material are shown below.

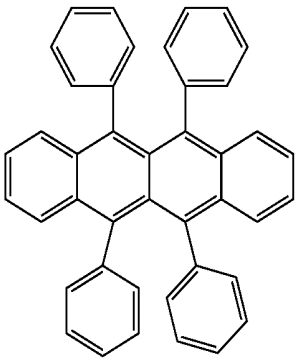


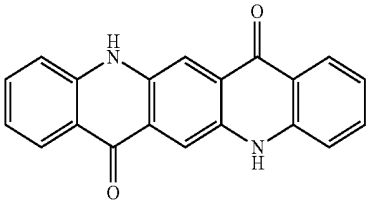






[0248] Preferred examples of a compound that may be added are shown below. For example, the compound may be added as a stabilizing material.





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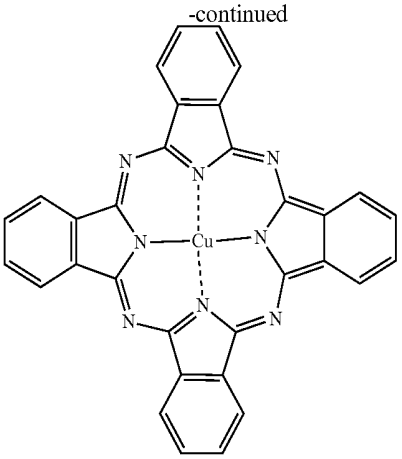
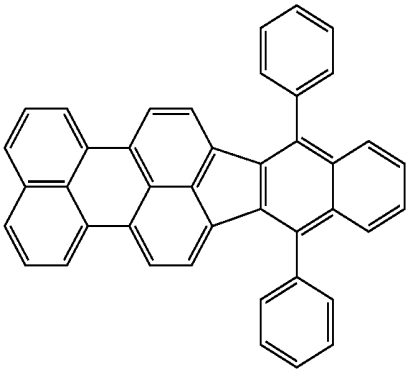
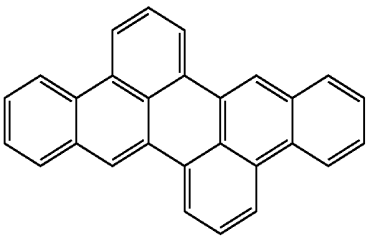






[0249] The organic electroluminescent device thus produced by the aforementioned method emits light on application of an electric field between the anode and the cathode of the device. In this case, when the light emission, is caused by the excited singlet energy, light having a wavelength that corresponds to the energy level thereof may be confirmed as fluorescent light and delayed fluorescent light. When the light emission is caused by the excited triplet energy, light having a wavelength that corresponds to the energy level thereof may be confirmed as phosphorescent light. The normal fluorescent light has a shorter light emission lifetime than the delayed fluorescent light, and thus the light emission lifetime may be distinguished between the fluorescent light and the delayed fluorescent light.

[0250] The phosphorescent light may substantially not observed with a normal organic compound, such as the compound of the invention, at room temperature since the excited triplet energy is converted to heat or the like due to the instability thereof, and is immediately deactivated with a short lifetime. The excited triplet energy of the normal organic compound may be measured by observing light emission under an extremely low temperature condition.

[0251] The organic electroluminescent device of the invention may be applied to any of a single device, a structure with plural devices disposed in an array, and a

structure having anodes and cathodes disposed in an X-Y matrix. According to the invention, an organic light-emitting device that is largely improved in light emission efficiency may be obtained by adding the compound represented by the general formula (1) in the light-emitting layer. The organic light-emitting device, such as the organic electroluminescent device, of the invention may be applied to a further wide range of purposes. For example, an organic electroluminescent display apparatus may be produced with the organic electroluminescent device of the invention, and for the details thereof, reference may be made to S. Tokito, C. Adachi and H. Murata, "Yuki EL Display" (Organic EL Display) (Ohmsha, Ltd.). In particular, the organic electroluminescent device of the invention may be applied to organic electroluminescent illumination and backlight which are highly demanded.

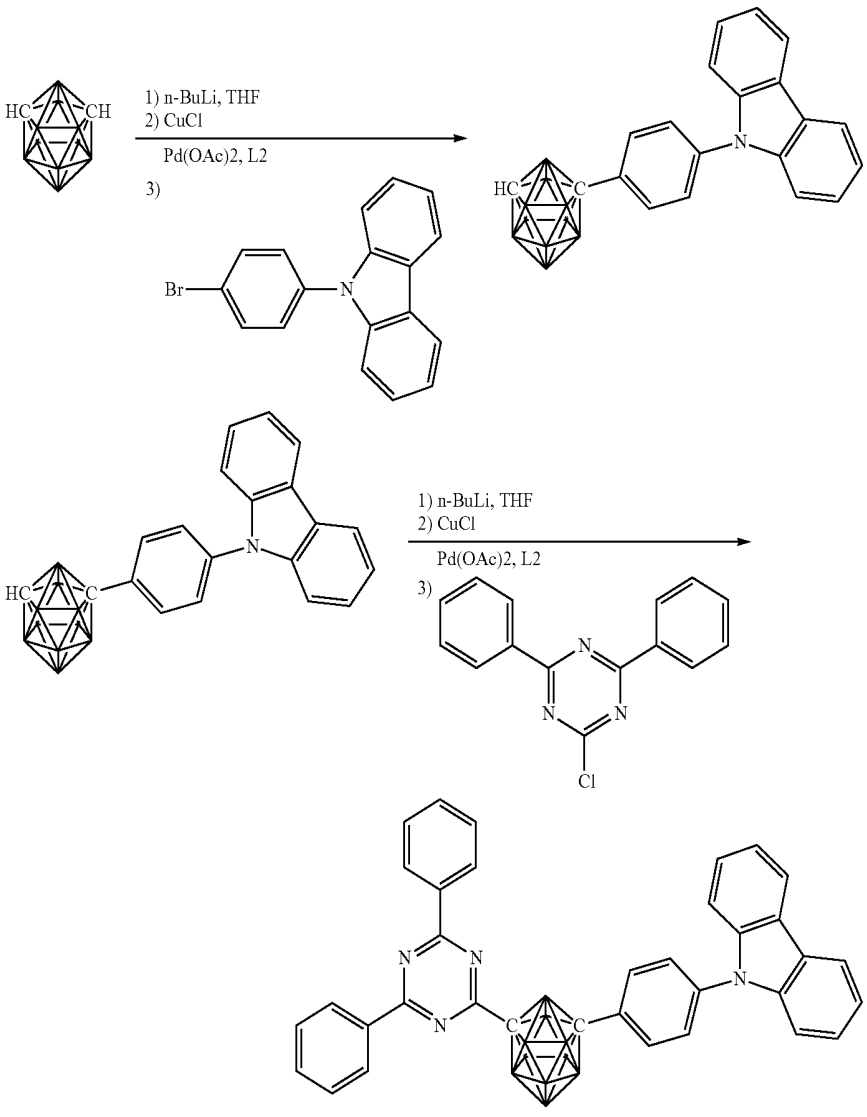
EXAMPLE

[0252] The features of the invention will be described more specifically with reference to synthesis examples and working examples below. The materials, processes, procedures and the like shown below may be appropriately modified unless they deviate from the substance of the invention. Accordingly, the scope of the invention is not construed as being limited to the specific examples shown below. The light emission characteristics were evaluated by using a source meter (2400 Series, produced by Keithley Instruments Inc.), a semiconductor parameter analyzer (E5273A, produced by Agilent Technologies, Inc.), an optical power meter (1930C, produced by Newport Corporation), an optical spectrometer (USB2000, produced by Ocean Optics, Inc.), a spectroradiometer (SR-3, produced by Topcon Corporation), and a streak camera (Model C4334, produced by Hamamatsu Photonics K.K.).

Synthesis Example 1

Synthesis of Compound 1

[0253]



Compound 1

[0254] m-Carborane (1.87 g, 13.0 mmol) was placed in a three-neck flask, which was then replaced by nitrogen. Thereafter, 80 mL of tetrahydrofuran was added thereto, the mixture was cooled to −78° C., and a 1.60 M n-butyllithium hexane solution (9.80 mL, 26.0 mmol) was slowly added dropwise thereto, followed by agitating at −78° C. for 15 minutes. Thereafter, the mixture was agitated at 0° C. for 1 hour, and copper(I) chloride (1.39 g, 14.3 mmol) was added thereto, followed by agitating at room temperature for 30 minutes. Thereafter, 100 mL of a tetrahydrofuran solution containing palladium(II) acetate (0.15 g, 0.676 mmol), triamethoxytriphenylphosphine (0.75 g, 2.13 mmol), and 9-(4-bromophenyl)carbazole (5.00 g, 15.6 mmol) was added, followed by agitating at room temperature for 48 hours. Thereafter, water and chloroform were added to the mixture, which was extracted therewith. The organic layer separated was dried over sodium sulfate, and suction-filtered to provide a filtrate. The resulting filtrate was purified by column chromatography and recrystallization, thereby providing 1-(4-carbazol-9-ylphenyl)-m-carborane (yield: 37.1%).

[0255] 1-(4-Carbazolylphenyl)-m-carborane (1.56 g, 4.0 mmol) was placed in a three-neck flask, which was then replaced by nitrogen. Thereafter, 80 mL of tetrahydrofuran was added thereto, the mixture was cooled to −78° C., and a 1.60 M n-butyllithium hexane solution (5.0 mL, 8.0 mmol) was slowly added dropwise thereto, followed by agitating at −78° C. for 15 minutes. Thereafter, the mixture was agitated at 0° C. fox 1 hour, and copper(I) chloride (0.52 g, 5.2 mmol) was added thereto, followed by agitating at room temperature for 30 minutes. Thereafter, 100 mL of a tetrahydrofuran solution containing palladium(II) acetate (0.047 g, 0.208 mmol), trismethoxytriphenylphosphine (0.23 g, 0.656 mmol), and 2-chloro-4,6-diphenyl-1,3,5-triazine (1.3 g, 4.8 mmol) was added, followed by agitating at room temperature for 48 hours. Thereafter, water and chloroform were added to the mixture, which was extracted therewith. The organic layer separated was dried over sodium sulfate, and suction-filtered to provide a filtrate. The resulting filtrate was purified by column chromatography, thereby providing the compound 1 (yield: 44.5%). The compound was identified by ^{1}H-NMR and elemental analysis.

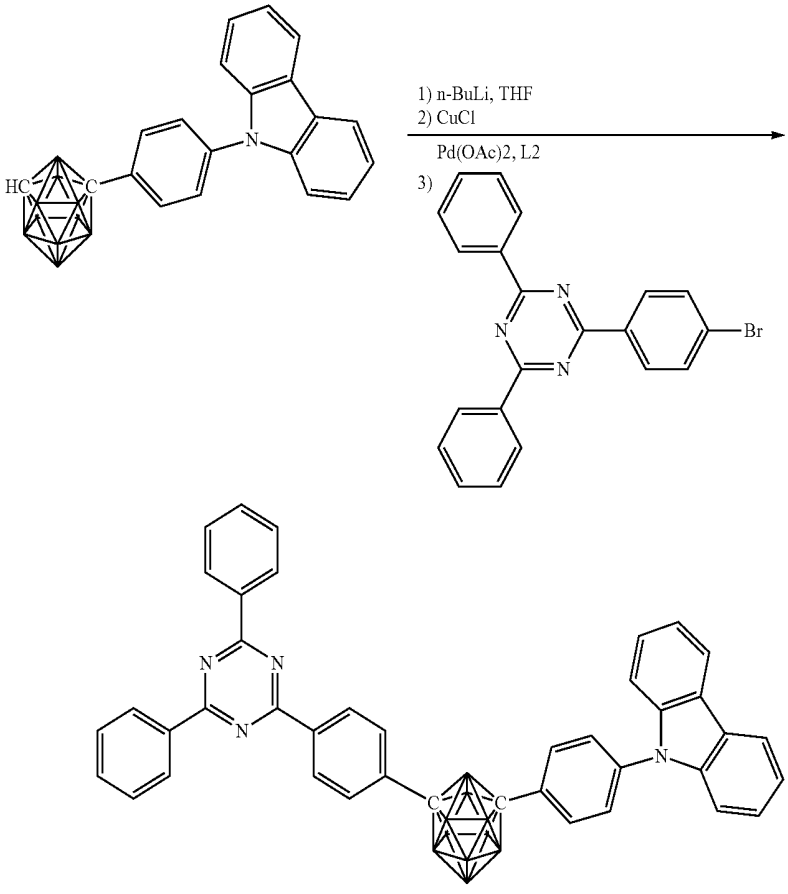
[0256] ^{1}H-NMR (500 MHz, $CDCl_3$, TMS, δ): 8.63 (d, J=7.0 Hz, 4H), 9.14 (d, J=7.5 Hz, 2H), 1.11 (d, J=8.5 Hz, 2H), 7.65-7.62 (m, 2H), 7.58-7.53 (m, 6H), 7.47-7.40 (m, 4H) 7.30 (t, J=9.0 He, 2H), 3.89-1.75 (br, 10H, B—H)

[0257] Elemental analysis: Anal. Calcd. for $C_{35}H_{32}B_{10}N_4$: C, 68.16%, H, 5.23%, N, 9.08%. found: C, 66.25%, H, 5.21%, N, 9.17%.

Synthesis Example 2

Synthesis of Compound 2

[0258]



Compound 2

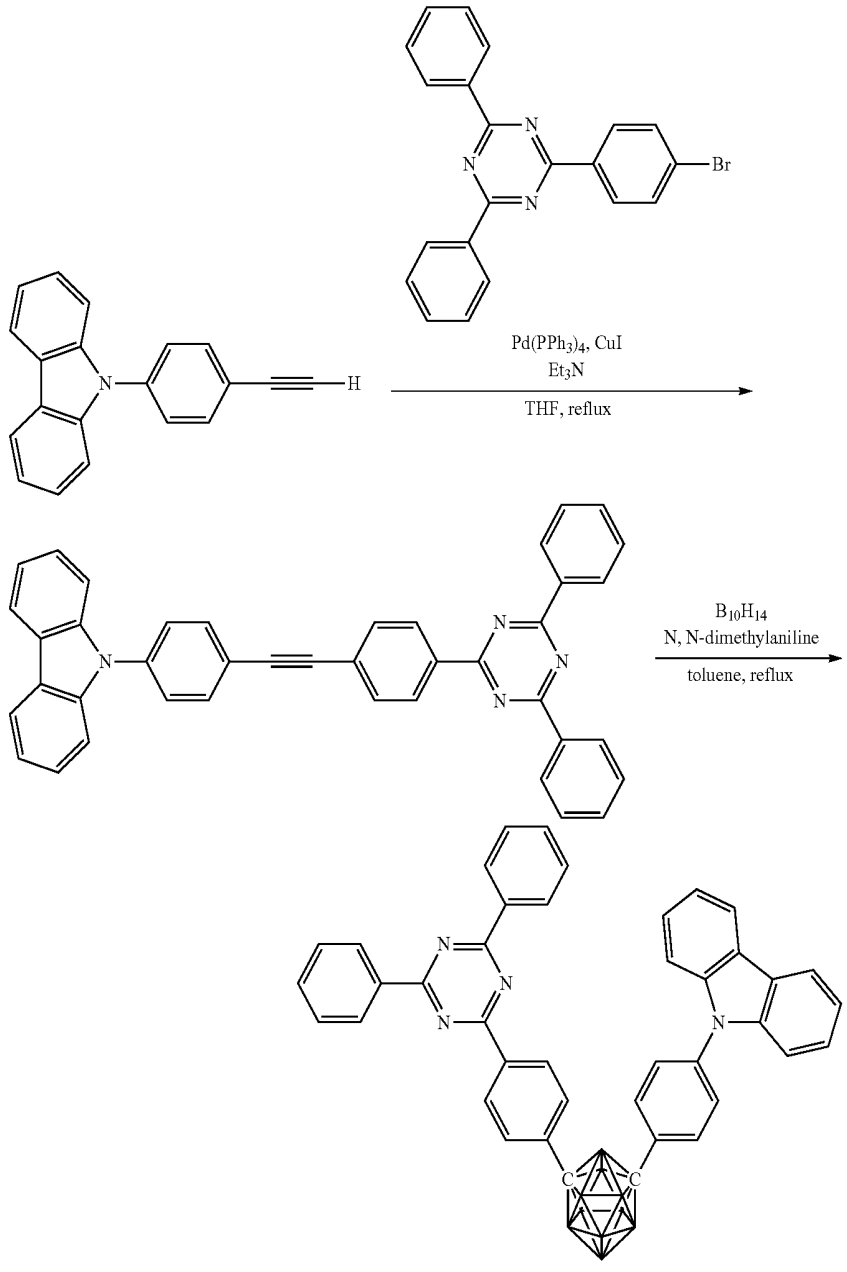
[0259] 1-(4-Carbazolylphenyl)-m-carborane (1.56 g, 4.0 mmol) was placed in a three-neck flask, which was then replaced by nitrogen. Thereafter, 80 mL of tetrahydrofuran was added thereto, the mixture was cooled to −78° C., and a 1.60 M n-butyllithium hexane solution (5.0 mL, 8.0 mmol) was slowly added dropwise thereto, followed by agitating at −78° C. for 15 minutes. Thereafter, the mixture was agitated at 0° C. for 1 hour, rind copper(I) chloride (0.52 g, 5.2 mmol) was added thereto, followed by agitating at room temperature for 30 minutes. Thereafter, 100 mL of a tetrahydrofuran solution containing palladium(II) acetate (0.047 g, 0.208 mmol), trisnethoxytriphenylphosphine (0.23 g, 0.656 mmol), and 2-(4-bromophenyl)-4,6-diphenyl-1,3,5-triazine (1.86 g, 4.8 mmol) was added, followed by agitating at room temperature for 43 hours. Thereafter, water and chloroform were added to the mixture, which was extracted therewith. The organic layer separated was dried over sodium sulfate, and suction-filtered to provide a filtrate. The resulting filtrate was purified by column chromatography, thereby providing the compound 2 (yield: 10.8%). The compound was identified by ^{1}H-NMR and elemental analysis.

[0260] ^{1}H-NMR (500 MHz, $CDCl_3$, TMS, δ): 8.77 (d, J=9.7 Hz, 4H), 8.69 (d, J=8.7 Hz, 2H), 8.14 (d, J=7.7 Hz, 2H), 7.75-7.72 (m, 4H), 7.65-7.57 (m, 6H), 7.53 (d, J=6.7 Hz, 2H), 7.47-7.40 (m, 4H), 6.5 (t, J=8.7 Hz, 2H), 3.80-1.76 (br, 11H, B—H)

Synthesis Example 3

Synthesis of Compound 3

[0261]



Compound 3

[0262] 9-(4-Ethynylphenyl)-9H-carbazole (2.13 g, 8.0 mmol) and brominated triphenyltriazine (2.06 g, 5.3 mmol) were placed in a three-neck flask, which was then replaced by nitrogen. Thereafter, 180 mL of triethylamine and 100 ml, of tetrahydrofuran wore added thereto for dissolution, and then tetrakis (triphenylphosphine) palladium(0) (0.31 g, 0.0266 mmol) and copper(I) iodide (0.05 g, 5.57 mmol) were added, followed by refluxing for 24 hours. Thereafter, water and chloroform were added to the mixture, which was extracted therewith. The organic layer separated was dried over sodium sulfate, and suction-filtered to provide a filtrate. The resulting filtrate was purified by column chromatography, thereby providing 9-(4-((4,6-diphenyl-1,3,5-triazin-2-yl)phenyl)ethynyl)phenyl)-9H-carbazole (yield: 39.3%).

[0263] Decaborane (0.231 g, 1.91 mmol) and N,N-dimethylaniline (0.580 g, 4.79 mmol) were placed in a 100 mL three-neck flask having been replaced by nitrogen, and dissolved with 50 ml, of toluene. The solution was agitated at room temperature for 30 minutes, and then heated for refluxing under agitating for 2 hours. Thereafter, the temperature thereof was lowered to 40° C., to which 9-(4-((4,6-diphenyl-1,3,5-triazin-2-yl)phenyl)ethynyl)phenyl)-9H-carbazole (1.0 g, 1.74 mmol) was added, followed by refluxing for 24 hours. Thereafter, water and chloroform were added to the mixture, which was extracted therewith. The organic layer separated was dried over sodium sulfate, and suction-filtered to provide a filtrate. A solid was obtained by reprecipitation and purified by sublimation, thereby providing the compound 3 (yield: 21.8%). The compound was identified by 1H-NMR and elemental analysis.

[0264] ^{1}H-NMR (500 MHz, $CDCl_3$, TMS, δ): 8.72 (d, J=8.5 Hz, 4H), 8.64 (d, J=8.5 Hz, 2H), 8.02 (d, J=7.5 Hz, 2H), 7.72-7.69 (m, 4H), 7.63-7.54 (m, 6H), 7.39 (d, J=8.5 Hz, 2H), 7.24-7.14 (m, 6H), 3.83-1.78 (br, 10H, B—H)

Example 1

Production and Evaluation of Organic Photoluminescent Device Using Compound 1 as Host Material

[0265] A light-emitting material containing 4CzIPN, and the compound 1 were vapor-deposited from separate vapor deposition sources on a quartz substrate by a vacuum vapor deposition method under condition of a vacuum degree of from 2 to 7.0×10^{-4} Pa, so as to form a thin film having a concentration of 4CzIPN of 3.0% by weight to a thickness of 100 nm, thereby providing an organic photoluminescent device.

[0266] FIG. **2** shows the light emission and absorption spectra of the organic photoluminescent device thus produced with excitation light of 280 nm. The photoluminescence quantum efficiency was 84.9%.

Example 2

Production and Evaluation of Organic Electroluminescent Device Using Compound 1 as Host Material

[0267] Thin films were laminated on a glass substrate having formed thereon an anode formed of indium tin oxide (ITO) having a thickness of 100 nm, by a vacuum vapor deposition method at a vacuum degree of from 2 to 7.0×10^{-4} Pa. Firstly, α-NPD was formed, to a thickness of 35 nm on ITO, and then mCP was formed to a thickness of 10 nm thereon. Subsequently, a light-emitting material containing 4CzIPN and the compound 1 were co-deposited thereon from separate vapor deposition sources to form a layer having a thickness of 20 nm, which was designated as a light-emitting layer. At this time, the concentration of 4CzIPN was 3.0% by weight. PPT was then formed to a thickness of 40 nm, further lithium fluoride (LiF) was vacuum vapor-deposited to a thickness of 0.8 nm, and then aluminum (Al) was vapor-deposited to a thickness of 80 nm to form a cathode, thereby completing an organic electroluminescent device.

[0268] FIG. **3** shows the light emission spectrum of the organic electroluminescent device thus produced at 10 mA/cm^2, FIG. **4** shows the voltage-current density-luminance characteristics thereof, and FIG. **5** shows current density-external quantum efficiency characteristics thereof. The organic electroluminescent device using the compound 1 as a host material exhibited a voltage of 3.9 V at a light emission wavelength of 501 nm at 1 cd/m^2, a voltage of 7.6V at 10 mA/cm^2, a luminance of 28,980 cd/m^2 at 10 V, and an external quantum efficiency of 19.4% at 0.01 mA/cm^2, which indicated a high external quant/am efficiency.

Example 3

Production and Evaluation of Organic Photoluminescent Device Using Compound 1 as Light-Emitting Material

[0269] Toluene solutions of the compound X having a concentrations of 10^{-3} M, 10^{-4} M, and 10^{-5} M were prepared in a glove box under an Ar atmosphere.

[0270] The compound 1 was vapor-deposited on a quartz substrate by a vacuum vapor deposition method under condition of a vacuum degree of from 2 to 7.0×10^{-4} Pa to form a thin film of the compound 1 to a thickness of 100 nm, thereby providing an organic photoluminescent device.

[0271] The specimens using the compound 1 were measured for light emission and absorption spectra with excitation light of 230 nm. FIG. **6** shows the light emission and absorption spectra of the toluene solutions before bubbling with nitrogen and the organic photoluminescent device measured in the air, and FIG. **7** shows the light emission and absorption spectra of the toluene solutions after bubbling with nitrogen and the thin film organic photoluminescent device measured in a nitrogen-containing atmosphere.

[0272] The photoluminescence quantum efficiency of the toluene solution of the compound 1 before bubbling with nitrogen was 1.9% for the toluene solution of 10^{-3} M, 2.1% for the toluene solution of 10^{-4} M, and 2.7% for the toluene solution of 10^{-5} M, and that after bubbling with nitrogen was 76.3% for the toluene solution of 10^{-3} M, 17.8% for the toluene solution of 10^{-4} M, and 5.3% for the toluene solution of 10^{-5} M. The photoluminescence quantum efficiency of the organic photoluminescent device having the thin film of the compound 1 was 33.9% measured in the air, and 47.0% measured in a nitrogen-containing atmosphere.

[0273] FIG. **8** shows the light emission spectra for fluorescent light, delayed fluorescent light, and total fluorescent light of the organic photoluminescent device having the thin film of the compound 1, and FIG. **9** shows the transient decay curve measured at 300 K thereof. The transient decay curve shows the measurement result of the light emission lifetime obtained by measuring the process where the light

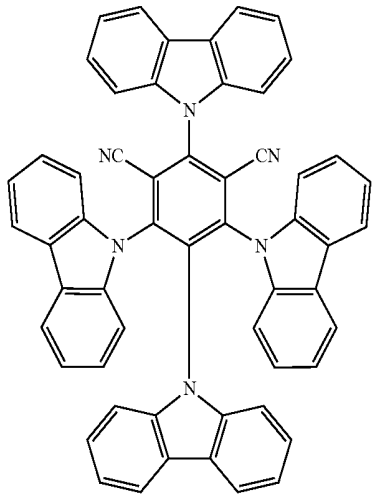
emission intensity is deactivated on irradiating the compound with excitation light. In ordinary one-component light emission (fluorescent light or phosphorescent light), the light emission intensity is decays monoexponentially. This means that the light emission intensity decays linearly on a graph with the semilogarithm as the ordinate. In a transient decay curve of the compound 1 shown in FIG. **9**, while a linear component (fluorescent light) was observed in the initial stage of observation, a component that deviated from the linearity appeared after several microseconds. The later component is light emission of the delayed component, and the signal thereof added to the initial component appears as a long tail curve on the longer time side. Thus, the measurement of the light emission lifetime revealed that the compound 1 was a light-emitting material that contained a delayed component in addition to a fluorescent component.

Example 4

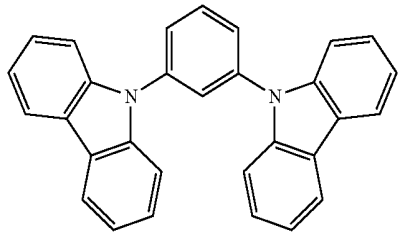
Production and Evaluation of Organic Photoluminescent Device Using Compound 2 as Light-Emitting Material

[0274] A toluene solution having a concentration of 10^{-3} mol/L was prepared in the same manner as in Example 3 except that the compound 2 was used instead of the compound 1.

[0275] FIG. **10** shows the light emission and absorption spectra of the toluene solution of the compound 2 thus prepared, with excitation light of 320 nm after bubbling with nitrogen. The photoluminescence quantum efficiency was 12.8%.

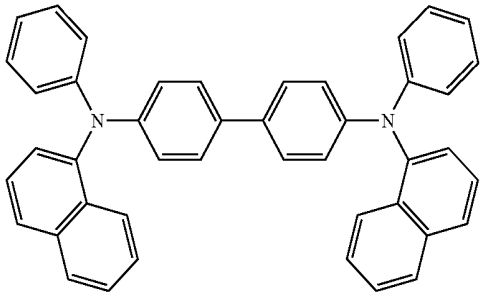


4CzIPN

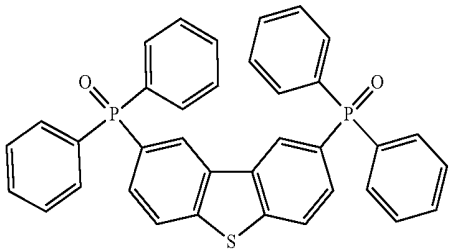


mCP

-continued



α-NPD



PPT

INDUSTRIAL APPLICABILITY

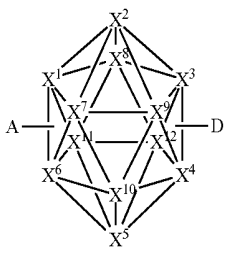
[0276] The compound represented by the general formula (1) is useful as a host material or a light-emitting material. Accordingly, the compound of the invention may be effectively used as a host material or a light-emitting material of an organic light-emitting device, such as an organic electroluminescent device. The compound of the invention includes a compound that emits delayed fluorescent light, and thus may be capable of providing an organic light-emitting device having a high light emission efficiency. Thus, the invention has high industrial applicability.

REFERENCE SIGNS LIST

[0277] **1** substrate
[0278] **2** anode
[0279] **3** hole injection layer
[0280] **4** hole transporting layer
[0281] **5** light-emitting layer
[0282] **6** electron transporting layer
[0283] **7** cathode

1. An organic light-emitting device comprising a compound represented by the following general formula (1):

General Formula (1)



wherein in the general formula (1), X^1 to X^{12} each independently represent C or BH constituting carborane, provided that among X^1 to X^{12}, the bonding positions to A and D each represent C, and the other thereof each represent BH; A represents an acceptor bonded to the carborane through an aromatic ring or a heteroaromatic ring; and D represents a donor bonded to the carborane through an aromatic ring or a heteroaromatic ring.

2. The organic light-emitting device according to claim **1**, wherein the organic light-emitting device contains the compound represented by the general formula (1) in a light-emitting layer.

3. The organic light-emitting device according to claim **2**, wherein the organic light-emitting device contains the compound represented by the general formula (1) as a host material.

4. The organic light-emitting device according to claim **3**, wherein the light-emitting layer further contains a delayed fluorescent emitter.

5. The organic light-emitting device according to claim **2**, wherein the organic light-emitting device contains the compound represented by the general formula (1) as a light-emitting material.

6. The organic light-emitting device according to claim **1**, wherein in the general formula (1), D is bonded to the carborane through a benzene ring.

7. The organic light-emitting device according to claim **1**, wherein in the general formula (1), D has a diphenylamino group or a carbazolyl group.

8. The organic light-emitting device according to claim **1**, wherein in the general formula (1), D represents a group represented by the following general formula (2):

$$[(R^1)(R^2)N]_{n1}—Ar^1— \qquad \text{General Formula (2)}$$

wherein in the general formula (2), R^1 and R^2 each independently represent a substituent, provided that R^1 and R^2 may be bonded to each other to form a cyclic structure; n1 represents an integer of from 1 to 4; and Ar^1 represents a substituted or unsubstituted aromatic group having a valence of (n1+1).

9. The organic light-emitting device according to claim **8**, wherein in the general formula (2), n1 represents 1 or 2.

10. The organic light-emitting device according to claim **1**, wherein in the general formula (1), A has a heteroaromatic ring containing a nitrogen atom.

11. The organic light-emitting device according to claim **10**, wherein in the general formula (1), A has a triazine ring.

12. The organic light-emitting device according to claim **11**, wherein the triazine ring is substituted with a phenyl group.

13. The organic light-emitting device according to claim **10**, wherein in the general formula (1), A is bonded to the carborane through the heteroaromatic ring containing a nitrogen atom.

14. The organic light-emitting device according to claim **10**, wherein in the general formula (1), A represents a group represented by the following general formula (3):

$$(Het)_{n2}\text{-}Ar^2— \qquad \text{General Formula (3)}$$

wherein in the general formula (3), Het represents a substituted or unsubstituted heteroaromatic ring group (provided that the heteroaromatic ring group contains a nitrogen atom as a ring structure constituting atom); n2 represents an integer of from 1 to 4; and Ar^2 represents a substituted or unsubstituted aromatic group having a valence of (n2+1).

15. The organic light-emitting device according to claim **14**, wherein in the general formula (3), n2 represents 1 or 2.

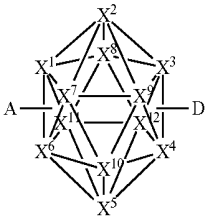
16. The organic light-emitting device according to claim **1**, wherein the compound represented by the general formula (1) is an o-carborane compound or a m-carborane compound.

17. The organic light-emitting device according to claim **1**, wherein the organic light-emitting device is an organic electroluminescent device.

18. The organic light-emitting device according to claim **1**, wherein the organic light-emitting device emits delayed fluorescent light.

19. A composition comprising a light-emitting material and a compound represented by the following general formula (1):

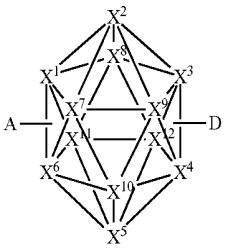
General Formula (1)



wherein in the general formula (1), X^1 to X^{12} each independently represent C or BH constituting carborane, provided that among X^1 to X^{12}, the bonding positions to A and D each represent C, and the other thereof each represent BH; A represents an acceptor bonded to the carborane through an aromatic ring or a heteroaromatic ring; and D represents a donor bonded to the carborane through an aromatic ring or a heteroaromatic ring.

20. A light-emitting composition comprising a compound represented by the following general formula (1):

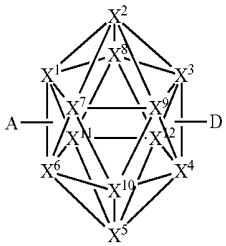
General Formula (1)



wherein in the general formula (1), X^1 to X^{12} each independently represent C or BH constituting carborane, provided that among X^1 to X^{12}, the bonding positions to A and D each represent C, and the other thereof each represent BH; A represents an acceptor bonded to the carborane through an aromatic ring or a heteroaromatic ring; and D represents a donor bonded to the carborane through an aromatic ring or a heteroaromatic ring.

21. A delayed fluorescent emitter comprising a compound represented by the following general formula (1):

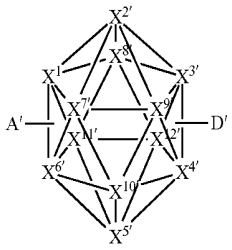
General Formula (1)



wherein in the general formula (1), X^1 to X^{12} each independently represent C or BH constituting carborane, provided that among X^1 to X^{12}, the bonding positions to A and D each represent C, and the other thereof each represent BH; A represents an acceptor bonded to the carborane through an aromatic ring or a heteroaromatic ring; and D represents a donor bonded to the carborane through an aromatic ring or a heteroaromatic ring.

22. A compound represented by the following general formula (1'):

General Formula (1')



wherein in the general formula (1'), $X^{1'}$ to $X^{12'}$ each independently represent C or BH constituting carborane, provided that among $X^{1'}$ to $X^{12'}$, the bonding positions to A' and D' each represent C, and the other thereof each represent BH; A' represents an acceptor bonded to the carborane through an aromatic ring or a heteroaromatic ring; and D' represents a donor bonded to the carborane through an aromatic ring or a heteroaromatic ring.

* * * * *

专利名称(译)	有机发光器件，主体材料，发光材料和化合物		
公开(公告)号	US20170213974A1	公开(公告)日	2017-07-27
申请号	US15/125286	申请日	2015-03-04
申请(专利权)人(译)	KYULUX，INC.		
当前申请(专利权)人(译)	KYULUX，INC.		
[标]发明人	ADACHI CHIHAYA YASUDA TAKUMA NISHIMOTO TAKURO LEE SAE YOUN		
发明人	ADACHI, CHIHAYA YASUDA, TAKUMA NISHIMOTO, TAKURO LEE, SAE YOUN		
IPC分类号	H01L51/00 C09K11/06 C07F5/02 C09K11/02		
CPC分类号	H01L51/008 C09K11/025 C09K11/06 H01L51/5012 C09K2211/1007 C09K2211/1059 C09K2211/1096 C07F5/027 C07D403/10 C07F5/02 C09K2211/1011 C09K2211/1029 H01L51/0045 H01L51/0067 H01L51/0072 H05B33/14		
优先权	2014047342 2014-03-11 JP		
其他公开文献	US10497883		
外部链接	Espacenet USPTO		

摘要(译)

通过使用通式（1）表示的化合物作为主体材料或有机发光器件的发光层的发光材料，可以实现高发光效率。 X 1 至X 12 各自独立地表示构成碳硼烷的C或BH，条件是X 1 至X 12 ，A和D的键合位置各自表示C，另一个表示BH; A表示通过芳环或杂芳环与碳硼烷键合的受体; D表示通过芳环或杂芳环与碳硼烷键合的给体。